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A NEW PSEUDOMASARIS FROM CALIFORNIA, WITH SOME CONSIDERATIONS ON THE MASARID WASPS (HYMENOPTERA)

BY J. BEQUAERT.

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While in Southern California, last spring, Professor W. M. Wheeler collected a large number of masarid wasps belonging to two species, one of which appears to be new. I have used the opportunity offered by the description of this insect, to present a few remarks of a more general nature on the Masaridinæ, by far the most interesting subfamily of diplopterous wasps. As I hope to show, their structure, habits and distribution exhibit a number of remarkable features that render the group worthy of consideration by the biologist.

Pseudomasaris (Pseudomasaris) wheeleri, new species

(Fig. 1)

A large, minutely sculptured, dull species; black, with numerous and rather variable sulphur-yellow markings, the mesonotum with two complete or interrupted longitudinal stripes, the abdomen often with a *Vespa*-pattern.

Length (h. + th. + t. 1 + 2): ♂, 10 to 10.5 mm.; ♀, 9 to 12 mm. (total length, approximately 13 to 17 mm.); of wing ♂, 12.5 mm. and ♀, 11 to 12.5 mm.

MALE.—Head broadly elliptical in front view, about one and one-fifth times as wide as high; seen from above, about twice as wide as long, much narrower than the thorax. Oc-

cipital margin of vertex far from the eyes, with a distinct inward curve, margined by a blunt carina which does not continue on the cheeks. Cheeks narrow, though distinct, about one-fourth the width of the eye in profile, gradually narrowed toward the vertex and evenly rounded in the lower half. Oculo-malar space short, but distinct, a little over one-fourth as long as the width of the mandibular articulation. Eyes more bulging than usual in the subgenus *Pseudomasaris,* proper. Inner orbits more than three times as far apart at the clypeus as on the vertex, where the eyes are separated by about three times the diameter of a posterior ocellus. Frons flat, not carinate, very faintly raised between the insertions of the antennae, with the merest trace of a median tubercle in the center, shallowly concave below the anterior ocellus. Ocular sinus deep, bluntly rounded at apex Ocelli large, in a flattened triangle; the anterior ocellus much larger than the others, subcircular; posterior ocelli about twice as far apart as their diameter, barely separated from the inner orbits, distant from an imaginary line connecting the posterior borders of the eyes by a little over twice their distance from each other. Interocellar area flat. Vertex strongly sloping posteriorly, slightly concave in front view. Antennæ about four times as far apart as they are removed from the inner orbits. Clypeus strongly and evenly convex throughout, in outline flattened hexagonal with rounded upper angles, nearly one and one-half times as wide as long; the anterior, free portion about one-fourth shorter than the basal, interocular part; the upper margin slightly convex; the upper lateral margins slightly oblique, very broadly separated from the eyes, the intervening space wider than the length of the oculo-malar space; the lower lateral margins slightly concave, forming almost right angles with the upper lateral margins; the truncate apex a little over half the maximum width of the clypeus, deeply, arcuately emarginate; the apical angles very broadly rounded, with a translucent border. Antenna of 12 segments, very long, shaped much as in *P. occidentalis,* but the third to seventh segments more slender than in that species; the third to sixth not at all enlarged at their apices; the seventh slightly and evenly widened toward the apex, where

it is less than half as wide as long; the terminal club of five very superficially separated segments, seen from above regularly short oval, sharply set off, much wider than thick, a little over one-half as wide as long, slightly longer than the sixth and seventh segments together, somewhat flattened dorsally, more convex ventrally where there is a slight

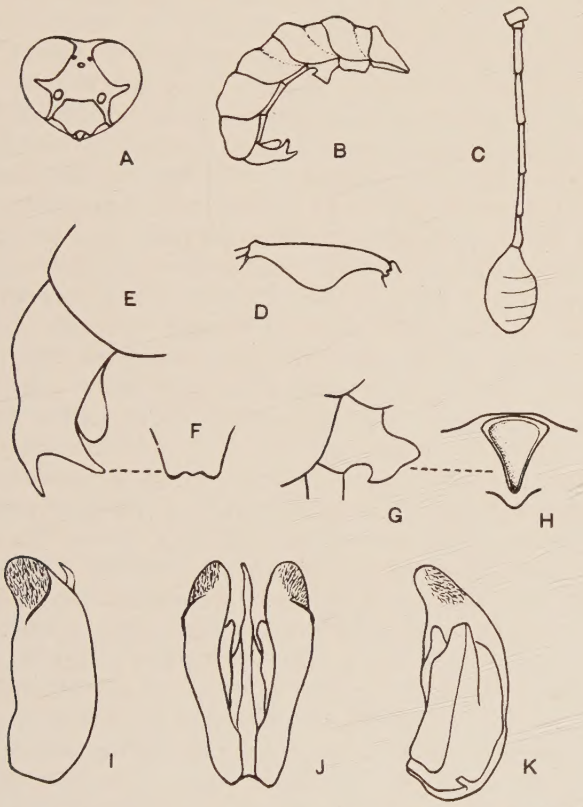

Fig. 1. *Pseudomasaris wheeleri* J. Bequaert. Male: A, head in front view; B, abdomen in profile; C, left antenna from above; D, right middle tibia in front view; E, seventh tergite in profile; F, apical margin of seventh tergite in dorsal view; G, third sternite in profile; H, apex of process of third sternite in ventral view; I, right side of genitalia in profile, showing external view of valva externa (squama of Bradley); J, genitalia in dorsal view; K, internal view of left valva externa (Bradley's squama), showing valva interna (Bradley's sagitta and volsella).

transverse depression close to the base. Mandibles folded beneath the labrum, smooth on the outer surface, ending in a long, finger-shaped, blunt apex, the inner margin with two faint denticulations before the apex. Thorax elongate rectangular, about one and one-fourth times as long as its greatest width, distinctly narrowed anteriorly and very slightly posteriorly, much lower than wide. Anterior margin of pronotum almost straight, rounded off, without carina or rim, slightly depressed in the middle; humeral angles slightly raised into blunt, broadly rounded humps. Mesonotum distinctly longer than wide, almost hexagonal in outline, the anterior margin forming a very low outward curve; slightly and uniformly convex in its anterior half, flattened in its posterior half; without traces of parapsidal furrows, but with a fine, incomplete furrow on each side in the posterior half (above the tegula) and a fine, median somewhat raised line in the anterior half. Tegula about two and one-half times as long as wide; the outer margin shallowly notched before the middle; the apex covering the base of the scutellum on the side. Scutellum very large, semi-elliptical, with a broadly rounded apical margin which does not entirely cover the postscutellum in a dorsal view; evenly convex throughout, with a very low, blunt, somewhat elongate, median tubercle close to the anterior margin; mesonotal suture not foveolate. Postscutellum very short; its median portion semi-elliptical from behind, divided into a very short, slightly swollen, anterior, horizontal portion (visible behind the scutellum from above) and a much longer, vertical, posterior area (in a plane with the concavity of the propodeum). Mesepisternum divided from the epimeron, but without a suture between the upper and the lower plates, without prepectal carina or suture and not depressed anteriorly into epicnemia for the front legs; the usual impressed line marking the sternopleural suture, distinct. Propodeum short, squarely and vertically truncate behind, very slightly convex on the sides from above; dorsal areas broadly separated from each other by the postscutellum, sloping gradually into the concavity (superior ridges not developed); lateral ridges blunt; inferior ridges carinate, sharp; concavity wide, very shallow, with a deeper median

depression which is divided by a low, blunt, longitudinal ridge starting behind the postscutellum and not reaching the abdominal articulation; lateral angle produced into a straight, broadly triangular, blunt, flattened tooth, directed posteriorly; the tooth continuous with the lateral ridge but set off rather sharply from the inferior ridge. Abdomen much elongate, of the shape usual in males of *Pseudomasaris;* the second, third and fourth tergites strongly constricted and depressed at the base. Armature of seventh tergite much as in *P. occidentalis*, but the preapical pair of tubercles longer and more finger-shaped, with a sharp carina at the base dorsally (in some specimens this carina is slightly more raised basad, behind a transverse depression of the tergite, on the spot where the fifth or sixth tubercle is situated in *P. vespoides*) ; the tubercles of the apical pair are also narrower than in *P. occidentalis* and are separated by a slight median projection of the hind margin. Second sternite slightly raised anteriorly, where there is a median notch separating two low tubercles (much less pronounced than in *P. occidentalis* and not continued posteriorly into blunt, oblique ridges as in that species). Process of third sternite in profile rather low and broad; its truncate summit forming an almost equilateral triangle, with a broad, shallow depression; its anterior angles bluntly rounded, without teeth; its posterior angle forming a short, but rather sharp tooth directed posteriorly (in general shape the process is more like that of *P. vespoides* than like that of *P. occidentalis*). Legs long and stout. Front femur and tibia slightly flattened beneath, their surfaces regular; the tibia slightly swollen; all the segments of the front tarsus ciliate along the outer margin. Middle femur regular, slightly flattened beneath where the posterior margin shows a faint indication of a notch before the base; middle tibia in front view strongly widened on the inferior edge, the dilatation semi-elliptical in outline, broadly rounded off, placed about the middle of the length of the tibia, slightly flattened on the inner side. Hind femur and tibia regular; the tibia gradually and moderately widened toward the apical half; hind basitarsus regular, slender, straight, not appreciably flattened. Middle tibia with one apical spur; larger spur of hind

tibia bifid at apex. Tarsal claws simple. Wings with the usual venation of *Pseudomasaris;* radial cell rather long and narrow; second cubital rather large, its length on the radius variable, often as long as the distance between the ends of the two recurrent veins on the cubitus; second intercubitus strongly bent below the middle. Genitalia (Fig. 1 *I-K*) essentially as in *P. occidentalis.*

Body mostly dull, densely and fairly uniformly covered with medium-sized and smaller punctures (visible with a hand-lens). Center of the frons more coarsely punctured. On mesonotum and scutellum the punctures are of two sizes, the larger ones especially numerous over the posterior portion of the mesonotum. Puncturation stronger on the basal constricted areas of the first three tergites than on the remainder of the abdomen. The following parts are impunctate and shiny: most of the outer surface of the mandible; the median depressed area of the concavity of the propodeum; a median, more or less triangular area at the base of the second to sixth tergites; and the middle of the seventh tergite very extensively at the base. Pubescence short, but rather abundant on head and thorax, sparser on the abdomen; mostly grayish, a little darker on mesonotum and vertex. Posterior edge of middle femur with dense, somewhat silvery brown pile on the under side.

Black, with the following areas sulphur-yellow: mandibles (except the long black apices); labrum (except the ferruginous tip); clypeus (except the upper margin very narrowly and minute dots in the center); a double spot on the frons above the insertions of the antennæ; the inner orbits from the base of the mandibles to the posterior ocelli, filling the ocular sinuses and widening on the frons to connect with the median spots; a small spot above each of the posterior ocelli; outer orbits, the yellow not reaching the vertex; most of the pronotum (except for a black, more or less triangular spot in the posterior half); a large spot in the upper part of the mesepisternum; tegulæ; a spot on each side of the mesonotum close to the hind portion of the tegula; four elongate spots over the middle of the mesonotum (forming two interrupted, diverging stripes); broad hind margin and extreme sides of scutellum; extreme sides

(lateral angles and ventral areas) of propodeum; broad apical bands on all tergites, those on the first to fourth very wide on the sides and abruptly narrowed, the median anterior margin wavy; all the sternites (except for the bases and the apical depressed area of the process of the third sternite); and most of the legs (front coxæ, trochanters and femora partly black above; middle and hind coxæ and trochanters black beneath; under side of middle and hind femora with a narrow black line; tarsi partly ferruginous). On the fifth abdominal tergite the yellow is very extensive and partly divided in the middle by a sharp projection from the black base, while there is a free, ovate, black spot on each side in the yellow; the yellow band of the sixth tergite is similar to that of the fifth, but there are no free black spots; the four tubercles of the seventh tergite are black and the two of each side are connected by a narrow black line. Antenna ferruginous to black; scape with a yellow apical band; third segment extensively yellow above; the fourth to sixth with some yellow streaks on the upper side; the club spotted with yellow at the base both above and beneath. Wings subhyaline, very slightly suffused with ferruginous brown in the costal, radial and first cubital cells and along some of the veins; the veins reddish brown, the stigma bright fulvous. The variations of the color in the males are slight: sometimes the frontal spots are much reduced or even lacking; the anterior margin of the postscutellum may be yellow in the middle; or the concavity of the propodeum may show two or three small yellow spots; the apical fasciæ of the first four tergites instead of being wavy, may be more angularly emarginate anteriorly.

FEMALE.—Agrees in most respects with the male, except as indicated below. Occipital margin almost straight. Eyes not bulging. Inner orbits distinctly, though very little farther apart at the clypeus than on the vertex. Frons entirely flat, without even a trace of median tubercle. Ocular sinus broader. Ocelli subequal, in a flattened triangle; the posterior ocelli a little closer to each other than to the eyes. Vertex flat, not sloping, without fovea. Antennæ about five times as far apart as they are from the inner orbits. Clypeus

relatively longer, about one and one-third times as wide as long; the apical, free portion a little less than half the length of the basal, interocular part. Antenna as in the female of *P. occidentalis,* of 12 segments; scape more elongate than in the male; second segment very small; third to sixth short, narrower than the remainder, which form an elongate-elliptical swollen club not abruptly set off at base; third segment slightly longer than the three following together. Mandible with a very broad, bluntly rounded apex and the merest indication of two preapical denticulations on the inner margin. Humeral angles very evenly rounded, not humped. The lateral angles of the propodeum sharper than in the male. Abdomen of the normal shape, without constrictions or processes; the second and third tergites slightly depressed transversely near the base. Legs normal.

Abdomen uniformly covered with minute punctures, without shiny areas at the bases of the tergites. Clypeus very coarsely punctate, the punctures even coarser than on the frons. Pilosity of the clypeus denser and longer than in the male.

Yellow markings more extensive and more variable than in the male. Tip of labrum, under side of antennal club and last segments of all tarsi partly ferruginous. The following areas are sulphur-yellow: mandible (except the broad black apex) ; most of labrum; clypeus (except for a median black mark in the form of a ring, a horse-shoe, or two half rings, sometimes reduced to four dots) ; inner orbits from mandibles to vertex, broader above the ocular sinuses, but separated from the frontal spot; a triangular spot on the frons, resting on the clypeus (sometimes reduced to two lines or to indefinite spots) ; outer orbits, not connected with the inner orbits; most of pronotum (a black stripe on each side, of variable width, often running from the anterior to the lateral margin, sometimes broken up in spots) ; most of mesopleura; tegulæ; four longitudinal stripes on the mesonotum, one above each tegula (sometimes much shortened) and two in the middle, diverging and somewhat hooked anteriorly (very rarely broken up) ; broad hind margin of scutellum; postscutellum (in one specimen mostly black) ;

most of the propodeum (sometimes with two or three black spots, rarely extensively black in the concavity); very broad apical margins to tergites one to five, variously marked with black as noted below; most of the sternites; and the legs (except for spots on the coxæ and occasional spots or streaks at the base of some or of all the femora). In an extreme yellow example, the dorsal surface of the abdomen is almost wholly yellow, only the bases of the tergites being black and emitting black projections into the yellow; on the first and second tergites these projections are median only; on the third, fourth and fifth there are three black notches, one in the middle and one on each side; on the sixth a black median line connects the base with the apex of the tergite. In the extreme black specimens, the apical margins are slightly narrower and in addition to the black notches there is a transverse black spot in the yellow on each side of the first three tergites; these spots may be free or connected with the lateral notches; sometimes they are barely indicated or present on the first tergite only.

Male, holotype, and female, allotype, in the Museum of Comparative Zoölogy, at Cambridge. Paratypes of both sexes will be deposited at the United States National Museum, the American Museum of Natural History, the Philadelphia Academy of Natural Sciences, the California Academy of Sciences, and the British Museum.

CALIFORNIA: Seven males (including the holotype) and fifty-four females (including the allotype), from Palm Springs, Riverside Co., collected by Professor W. M. Wheeler at flowers of Yerba Santa, *Eriodictyon tomentosum* Bentham, in April 1928.

Although the eyes of the male are much more bulging than is customary in the subgenus *Pseudomasaris*, proper, with the posterior ocelli almost touching the eyes which are only separated by three times the diameter of a posterior ocellus, it is impossible to include *P. wheeleri* in the subgenus *Holopticus*, since the upper orbits are still far removed from the occipital margin. Moreover, the new species is very closely allied to *P. occidentalis* (Cresson), as shown

by a comparison of specimens.[1] Both species have practically the same peculiar structure of the legs in the male. Bradley (1922, Univ. of California Publ. Ent., I, No. 9, p. 424) writes of the male of *P. occidentalis*: "the middle tibia seen from in front with its inferior edge at the basal third strongly dilated and angulate." As a matter of fact, in that species the middle tibia is almost exactly as I describe and figure it for *P. wheeleri*. The two species are, nevertheless, readily separated in the males by the shape of the head (eyes not bulging in *P. occidentalis*, separated on the vertex by at least five times the diameter of a posterior ocellus, which is distinctly removed from the inner orbit), of the four tubercles of the seventh tergite (the preapical tubercles much shorter in *P. occidentalis* and not sharply carinate at the base), and of the process of the third sternite (in *P. occidentalis* the summit is very narrow, with a longitudinal groove which is abruptly widened anteriorly). The slight differences in the genitalia to be noted between my figures of *P. wheeleri* and those given by Bradley for *P. occidentalis* (1922, *Op. cit.*, Pl. X, figs. 62-64) are probably accidental and due to the method of preparation. On the other hand, the females of the two species are structurally so much alike, that after a very careful comparison I can only point out the following differences: in *P. occidentalis* the vertex is wider, the inner orbits being there about as far apart as at the clypeus and the posterior ocelli being also distinctly more removed from the inner orbits than from each other; the clypeus is decidedly longer, being but little wider than long. Of course the coloration of the two species is strikingly different in both sexes.

Incidentally it may be noted that the character used by Bradley in his working key (1922, *Op. cit.*, p. 381) to separate *Masaris* from *Pseudomasaris, viz.*, postscutellum covered or not covered by the scutellum, is not very reliable. In *P. wheeleri* the postscutellum may distinctly be seen in a dorsal view, protruding beyond the apex of the scutellum, although this is more marked in the male than in the female.

[1] I have been able to examine a pair of *P. occidentalis*, kindly loaned to me by the United States National Museum, through Miss Grace Sandhouse.

The true distinguishing features between the two genera are, however, correctly given by Bradley in his synoptic table of the genera (1922, *Op. cit.*, p. 389).

Additional Records of Pseudomasaris

The following records extend the known range of the genus and of some of the species. Some of the specimens belong to the collections of the Museum of Comparative Zoölogy at Cambridge (M. C. Z.).

1. *P. vespoides* (Cresson).—Arizona: Grand Canyon. 1 ♂ (G. P. Engelhardt). Colorado: Cripple Creek Rd. (Corley Mt. Highway), Teller Co., 8,930 ft., at flowers of *Pentstemon glaber* Pursh, 3 ♀ and 1 ♂, July 1, 1928 (J. Bequaert) the females disappear entirely within the flowers; the males, however, were flying very swiftly from flower to flower in search of the females; it was noted that the smaller *Pentstemon confertus* Douglas, although much more abundant in that particular spot, did not attract any masarid. Plainview, Jefferson Co., 8 ♀ and 1 ♂, July 9 to 14, 1922 (G. P. Engelhardt). Boulder, 1 ♀ (M. C. Z.). Platte Canyon, 1 ♀ (M. C. Z.). Hall's Valley, 2 ♂, August. Utah: Eureka, 1 ♂ (T. Spalding) (M.C.Z.). California: Lakeside, 1 ♂ (E. P. Van Duzee) (M. C. Z.). Tallac, Eldorado Co., 6,000 ft., 1 ♀ (W. M. Giffard) (M. C. Z.).

2. *P. texanus* (Cresson).—Texas: Waco, 2 ♀ (M. C. Z.).

3. *P. zonalis* (Cresson).—Colorado: Plainview, Jefferson Co., 4 ♀ and 1 ♂, July 9 to 14, 1922 (G. P. Engelhardt). California: Alta Mesa, 1 ♀. Washington: Skagit Valley, 1 ♂ (M. C. Z.). British Columbia: Princeton, 1,800 ft., 1 ♂ (M. C. Z.).

4. *P. edwardsii* (Cresson).—Utah: Logan, 1 ♂ (E. S. G. Titus) (M. C. Z.). California: Alpine, San Diego Co., 1 ♂ (E. P. Van Duzee) (M. C. Z.). Palm Springs, Riverside, Co., 8 ♀, at flowers of *Phacelia* sp., April 1928 (W. M. Wheeler).

5. *P. marginalis* (Cresson).—Colorado: Granite Peaks Camp on the Pine River, near Bayfield, La Plata Co., 9,000

ft., 18 ♀, at flowers of *Phacelia heterophylla* Pursh, July 16 to 21, 1928 (J. Bequaert). These insects were active only during the warmest hours of the day and in bright sunshine. Most of the specimens were observed between 9 A. M. and 1 P. M. Although many other flowers were carefully watched for insect visitors and some species of *Pentstemon* were growing in that locality, *P. marginalis* was seen visiting only *Phacelia heterophylla*. No male was ever seen near the flowers.

Characters of the Masaridinæ

The subfamily Masaridinæ is one of the best-defined groups among the Vespidæ, or folded-winged wasps. It agrees with the other Diploptera in having the first discoidal cell (M^1) of the fore wing at least as long as the submedian ($Cu+Cu_1$), the only peculiar character that holds good throughout the entire family Vespidæ. Yet it should be observed that this peculiarity of the wing is not as strongly marked, as a rule, in the Masaridinæ as in most other subfamilies of Diploptera (with the exception of the Gayellinæ and Euparagiinæ). The lengthening of the first discoidal cell is evidently correlated with the longitudinal plaiting of the wing, a feature not or but faintly shown by most Masaridinæ. In this connection it is noteworthy that in the few masarid genera *(Quartinia* and *Celonites)* in which the fore wings are strongly plaited, the first discoidal cell is very long. The wing of *Celonites,* for instance, differs hardly in this respect from that of *Vespa.*

The one distinguishing character of all Masaridinæ, not found elsewhere among the Diploptera, is the simplified venation of the hind wing, in which the transverse median vein (M^3) is straight and not angulate, the discoidal vein ($m+M_2$) being apparently wanting. But, as shown by Bradley (1922, *Op. cit.,* p. 374), the position of the preaxillary excision seems to warrant the conclusion that the apical section of the anal vein (M_1+Cu_{1+2} + 1st A + 2d A) has become lost, and not the true discoidal vein ($m+M_2$). The hind wing must therefore be regarded as highly specialized and not as primitive.

In the remaining characters, the Masaridinæ exhibit a

strange mixture of primitive (or generalized) and of specialized features. The inner orbits are, as a rule, deeply emarginate; the most notable exceptions being the Australian *Paragia,* in which they are merely sinuate (they are, however, distinctly emarginate in the allied *Metaparagia,* likewise of Australia), the South African *Ceramioides,* in which the emargination is very broad and shallow (the related *Ceramius* and *Paraceramius* have it quite deep), and the South American *Ceramiopsis.* Since the emargination of the eyes is commonly found in other related families of Hymenoptera, such as Scoliidæ, Sapygidæ, and Mutillidæ, it is most probably a very old character, inherited from the common ancestral stock of all Diploptera. In this case the sinuate or subentire inner orbits should be regarded as a secondary or specialized condition.

The mandibles are generally broad and short, folding over each other beneath the labrum or very slightly decussate. This may be regarded as the primitive condition retained by many Vespidæ (except Eumeninæ and Stenogastrinæ).

The clypeus is either truncate at apex or very broadly rounded, the more common and evidently primary condition among the Diploptera, where the pointed clypeus is only found as the rule in Ropalidiinæ, Polistinæ, Polybiinæ, and Stenogastrinæ, and very exceptionally elsewhere.

The antennæ are always composed of twelve segments in both female and male, although the terminal segments are often coalescing and hard to differentiate in the male.[1] In almost all other Vespidæ (including Gayellinæ and Euparagiinæ) the number of segments differs in the two sexes: as a rule it is 12 in the female and 13 in the male; in certain genera (*Belonogaster, Polybioides*) it is 11 in the female and 12 in the male. Another exception to the rule is the genus *Pachodynerus,* among the Eumeninæ, where both sexes have 12 segments. Many Masaridinæ show a marked tendency to a shortening of the scape and to a

[1]Bradley (1922, *Op. cit.,* p. 389) states that in the female of *Trimeria* the antenna has only 11 segments. He had, however, not examined a specimen of that sex. In a female of *T. buyssoni* before me the antenna is distinctly 12-segmented.

swelling of the terminal segments of the flagellum into a club. But this is far from being the rule, since the antennæ of *Trimeria, Microtrimeria, Ceramius, Paraceramius, Ceramioides, Paragia,* and *Metaparagia* have the flagellum not more swollen than many members of the other subfamilies. The equal number of antennal segments in both sexes should, I believe, be regarded as primitive.

The mouth-parts are of two distinct types. In *Paragia* and *Metaparagia,* they have retained the more primitive condition, as is also the rule among the other subfamilies of Vespidæ: the ligula is short and not retractile, composed of two short glossæ which are but little longer than the paraglossæ; the palpi are well developed, the maxillary palpi 6-segmented, the labial palpi 4-segmented. In the remaining genera of Masaridinæ, the mouth-parts are highly specialized, being modified into a proboscis, or sucking tube, composed of the elongate, retractile glossæ which are much longer than the paraglossæ; when withdrawn in the buccal cavity, the labium forms a loop which may enormously distend the membrane of the neck; the maxilla, however, remains short, and there is often a reduction of the number of segments of the palpi. This modification of the trophi is, as we shall see, correlated with the highly specialized, anthophilous diet of these wasps. Unfortunately the habits of *Paragia* and *Metaparagia* are as yet entirely unknown, but it is possible that they may show some relation to the different structure of their mouth-parts. It should be noted that the proboscis of the anthophilous Masaridinæ, although having the same function as that of the Apoidea, or bees, has a different morphology, since the maxillæ and labial palpi never form any part of it.

The most striking feature of the thorax is the unusual development of the scutellum which shows a tendency to overlap and crowd out the postscutellum. This character is, however, present in *Euparagia* also. The parapsidal furrows are completely preserved in some genera (*Trimeria, Microtrimeria, Paragia, Masariella, Ceramius*) ; in others they are indistinct (*Paraceramius, Jugurtia*) or absent (*Masaris, Pseudomasaris, Celonites*). The mesepisternum may either show the primitive division into an upper and a

lower plate (*Trimeria, Microtrimeria, Masariella, Ceramioides*) or have the plates partly (*Ceramius, Paraceramius*) or completely (*Masaris, Pseudomasaris*) fused.

H. de Saussure attached a considerable importance to the number of spurs of the middle tibia, which he believed to be two throughout the subfamily. Later observations have, however, shown that this number is not a subfamily character. In the Masaridinæ it is very variable, although fixed in each species and in most of the genera. Two spurs are found in *Microtrimeria, Paragia, Ceramius, Masaris, Masariella, Jugurtia, Celonites* and *Quartinia*; but in some cases, as in certain species of *Masariella*, the second spur is very small. On the other hand, *Trimeria, Paraceramius, Ceramioides*, and *Pseudomasaris* have but one spur. The two spurs probably represent the primitive condition. The tarsal claws likewise are variable, toothed in most genera, but simple in *Trimeria, Microtrimeria*, and *Pseudomasaris*.

Some of the peculiarities of the wing venation have been discussed above. As a rule the fore wing shows none of the longitudinal plaiting so characteristic of the Vespidæ when these insects are at rest. It should be observed, however, that the plaiting is likewise lacking or vestigial in the Euparagiinæ and Gayellinæ; while some Masaridinæ, such as *Ceramius*, show a distinct indication of it and others, such as *Celonites* and *Quartinia*, have the wing as strongly plaited as *Vespa*. Resting *Celonites* place the folded wings against the under side of the abdomen, as observed by J. Lichtenstein for the Mediterranean *C. afer* and by H. Brauns for several South African species. Throughout the subfamily there are but two closed cubital cells, the second and third (R^4+R^5) of the other Vespidæ being fused. To judge from the course of the two recurrent veins, it would seem that this feature of the wing was derived from the more common type of vespid venation, in which the second cubital cell (R_5) receives both recurrent veins, and not from the (perhaps more primitive) condition of the Euparagiinæ, Gayellinæ, and Raphiglossinæ in which the second and third cubital cells each receive a recurrent vein. Among the other subfamilies of Vespidæ the fusion of the second and third cubital cells is exceptional (as in

Paraicaria, where it is possibly the rule, and *Paramasaris,* where it is variable) or abnormal. In the hind wing the anal lobe is well developed as in most other Vespidæ (except Vespinæ), but is a small, circular or oval flap; the preaxillary excision is a mere undulation of the hind margin.

The number of segments of the abdomen is the same as in the other Diploptera, six in the female and seven in the male; but the posterior segments are not or only partly retractile within the second. The abdomen is always elongate and depressed, the venter being often flattened; in *Celonites* it is even slightly concave beneath and sharply margined on the sides (as in the Chrysididæ). The first segment is, as a rule, broadly truncate and "sessile" (that is articulated with the thorax without intervening stalk). Some of the South African *Ceramioides* have the first segment somewhat set off from the remainder of the abdomen or subpetiolate, and *Ceramiopsis* has the first segment narrowed into a short petiole.

Habits and Life History of the Masaridinæ

As stated above, the highly specialized trophi of most Masaridinæ are correlated with their peculiar habits. So far as known at present, these wasps differ from all other subfamilies of Diploptera in being exclusively plant-feeders in both the larval and adult stages.[1] The adults are anthophilous in both sexes and the females supply the larvæ with honey and pollen only. All other Vespidæ are at least partly predaceous and their larvæ feed exclusively or mostly upon animal prey. The only possible exception is *Nectarina,* a genus of honey-storing social wasps; but I have been unable to find definite observations showing that the larvæ of these wasps are fed on honey only. Even the Raphiglossinæ store insects for their larvæ, although the adults are

[1] *Euparagia* is not a masarid wasp, but belongs to a distinct subfamily, Euparagiinæ, as shown by Bradley (1922, *Op. cit.,* p. 379). F. X. Williams (1927, Pan-Pacific Entomologist, IV, pp. 38-39) found that it is predaceous and stores its cells with curculionid larvae.

highly anthophilous and have the trophi as much modified into a proboscis as the Masaridinæ.[2]

That the Masaridinæ assiduously visit flowers has been observed in various parts of the world, but the genus or species of plant selected has not often been mentioned. This is, however, a point of some biological importance to which the attention of future observers should be called. From the few definite records it would appear that most of the species show a decided preference for flowers with fully-concealed nectar and, moreover, have a tendency to be oligotropic. In a given locality every species gathers pollen and nectar from one or a few species of plants, at least at one particular season.

Time has not allowed me to collect all observations scattered in the literature of Masaridinæ visiting flowers, but the following are believed to be representative for the group. In South Africa, according to H. Brauns, the species of *Celonites, Masariella, Ceramius,* and *Quartinia* all visit flowers actively, but the species of plants selected are not mentioned. In the Mediterranean Subregion, I have taken *Quartinia major* Kohl at flowers of *Chrysanthemum Myconis* Linnæus (near Algiers) and *Celonites afer* Lepeletier at those of *Echium confusum* de Coincy (near Oran). Dours mentions that he took *Celonites afer* and *Jugurtia oraniensis* (Lepeletier) in Algeria at flowers of *Bupleurum maritimum* Linnæus. *Celonites abbreviatus* (Villers) was observed by H. Loew visiting *Calamintha alpina* (Linnæus) (at Pontresina) and by H. Friese on *Teucrium montanum* Linnæus (in Thuringia). In Paraguay, *Trimeria howardi* Bertoni was seen by de Winkelried Bertoni visiting the flowers of *Talinum patens* (Jacquin). Much more complete are the observations relating to the North American *Pseudomasaris*. Some of these have been given above. In addition, *P. vespoides* (Cresson) has been observed by A. Davidson, in California, visiting *Pentstemon spectabilis* Thurber; by Cockerell, in New Mexico, eating the pollen of a species of *Pentstemon*; and by F. E. Clements and F. L. Long, in the

[2]The habits of the Gayellinae *(Gayella* and *Paramasaris)* are totally unknown.

region of Pike's Peak, Colorado, at the flowers of *Calochortus Gunnisonii* Watson, *Geranium cæspitosum* James, *Mertensia ciliata* (Torrey) (=*sibirica* Don), *Monarda fistulosa* Linnæus, *Prunus melanocarpa* (A. Nelson) (=*demissa* of authors), *Pentstemon glaber* Pursh, *P. glaucus* Graham, *P. gracilis* Nuttall, *Rubus deliciosus* James, and *R. strigosus* Michaux. Bradley records *P. texanus* subsp. *neomexicanus* Rohwer at flowers of *Astragalus, P. phaceliæ* Rohwer at those of *Phacelia neomexicana* Thurber, and *P. coquilletti* Rohwer at those of *Eriodictyon crassifolium* Bentham.

Since the nesting habits are known for only a few of the genera, it may be useful to review them briefly. Our most important lacuna in this respect concerns the Australian genera *Paragia* and *Metaparagia,* the behavior of which may well be totally different from that of the other Masaridinæ.

Celonites.—The nesting habits of *Celonites abbreviatus* (Villers) were first described by J. Lichtenstein (1869, Ann. Soc. Ent. France, (4) IX, Bull., p. xxix) after observations made by H. Westphal in southern France. The female builds free cells of mud which she places one behind the other on dry stalks of plants and in which she stores a honey paste as food for the larva. (Some additional details are given by J. Giraud, 1871, Ann. Soc. Ent. France, (5) I, p. 379). More complete observations were made with this species by C. Ferton (1901, Ann. Soc. Ent. France, LXX, p. 139; and 1910, *Op cit.,* LXXIX, pp. 174-176), also in southern France. He found the nest fixed to stones. He states that the female lays the egg first, before bringing in any provisions, and that the full-grown larva lines the walls of the cell with a thin layer of silk. His account also seems to indicate that the female uses mass provisioning.

C. afer Lepeletier (= *C. fischeri* of authors, not of Spinola) was likewise studied in southern France by J. Lichtenstein (1875, Ann. Soc. Ent. France, (5) V, Bull., p. ccxi), who found its habits similar to those of *C. abbreviatus.* Nurse, near Aden, southern Arabia, also bred from cylindrical mud cells a species referred by Bingham to *C. fischeri* (C. T. Bingham, 1898, Jl. Bombay Nat Hist. Soc., XII, 1, p. 111).

Ceramius.—Fonscolombe (1835, Ann. Soc. Ent. France, IV, p. 421), in southern France, observed a female of *C. fonscolombei* Latreille entering a gallery burrowed in the soil and provided at the entrance with a chimney of mud.

In South Africa, according to H. Brauns (1911, Zeitschr. Wiss. Insektenbiol., VI, pp. 387 and 445-446), *C. beyeri* Brauns, *C. lichtensteini* (Klug) and its var. *macrocephalus* H. de Saussure, likewise nest in the soil, building an erect or curved, free chimney of mud at the entrance. In *C. lichtensteini,* the female excavates a chamber at the end of the gallery, sometimes at a depth of four to five feet; here she masons oval cells of mud, in which she feeds the larvæ from day to day with flower nectar.

Paraceramius.—J. Giraud (1871, Ann. Soc. Ent. France, (5) I, pp. 375-379) has given a good account of the habits of *P. lusitanicus* (Klug), of which he observed a populous colony in southern France. The nest is similar to that of *C. fonscolombei* and likewise provided with a chimney at the entrance. At the end of the subterranean gallery the female masons a mud cell in which she feeds the larva from day to day with a mixture of pollen and nectar. C. Ferton (1901, Ann. Soc. Ent. France, LXX, pp. 137-139) completed these observations. He noted that the egg was laid in the bottom of the cell before the first load of honeypaste was brought in and that it was not attached to the wall by a thread. It would seem that he too observed progressive provisioning, although he is not explicit about this point.

Ceramioides.—The nesting habits have been observed in South Africa by H. Brauns (1911, *Op. cit.*) for *C. schulthessi* (Brauns), *C. linearis* (Klug) (=*C. fumipennis* Brauns), *C. bicolor* (Thunberg) (=*C. karrooensis* Brauns) and *C. capicola* (Brauns). They do not differ from those of *Ceramius lichtensteini.* The entrance to the nest may be protected either by a free chimney, erect or curved, or by a tunnel built on the ground.

Pseudomasaris.—Ashmead first mentioned breeding *P. vespoides* from a free mudnest (1902, Canad. Entom., XXXIV, p. 219). A. Davidson (1913, Bull. S. California Ac.

Sci., XII, pp. 17-18) also said that this species builds lumps of mud, attached to rocks or twigs and of stony hardness. He claimed, however, that the cells were stored with insect larvæ, but he must have made a confusion with the nests of some other mud dauber, since Hicks' observations, recorded below, show conclusively that *P. vespoides* is a pollen provisioning wasp. T. D. A. Cockerell (1913, Proc. Ent. Soc. Washington, XV, p. 107) stated that this same species was bred by G. Robertson, at Redlands, California, from a nest having the shape of an inverted cone and composed principally of sand, fastened to the stem of some plant. C. H. Hicks' observations on *P. vespoides* (1927, Canad. Entom., LIX, pp. 75-79) are much more complete than those made on any other masarid wasp. He found that, near Boulder, Colorado, the extremely hard mud nests are attached to rocks. The number of cells varies from 2 to 13 in one nest, each cell being about 2 to 3 cm. high; they are all placed vertically side by side, so that the tops, each provided with a cup-shaped depression, are in a straight line. A store of pollen was found in some of the cells, while others of the same nest contained full-grown larvæ from which adult wasps were bred. It would appear that this species uses mass provisioning, since several closed cells were found each containing a large mass of pollen. Before pupating the mature larva spins a light brown, silky lining over the wall of the cell.

At one time is was believed that some at least of the Masaridinæ might be parasitic wasps, but there is no evidence in support of this view. Dours claimed that *Celonites* was parasitic upon *Scolia* and his supposed observations were reproduced by H. de Saussure (1854, Et. Fam. Vesp., III, pp. 35-36). A. de Winkelried Bertoni (1921, Rev. Soc. Cientif. Paraguay, I, p. 11) also stated that his *Ceramiopsis paraguayensis* was parasitic of an anthophorid bee, because he saw this wasp entering a vertical gallery in the soil with a "mouth-piece" similar to that of *Epicharis obscura* Friese. But the inference is almost certainly erroneous, since we know that many masarids that nest in the ground build chimneys at the entrance to their galleries.

Distribution of the Masaridinæ

Not the least remarkable feature of the subfamily Masaridinæ is its present discontinuous distribution, as shown on the map (Fig. 2). This is further emphasized by an examination of the area occupied by the several genera.

Paragia.—20 species in Australia, 1 in Tasmania.[1]

Metaparagia.—3 species in Australia.

Ceramiopsis.—2 species in southern Brazil and Paraguay.

Trimeria.—5 species in subtropical South America.

Microtrimeria.—1 species in Peru.

Ceramius.—4 species in the Mediterranean Subregion and 7 in South Africa. Several of the South African species are known from females only; some of these may be only color variations, while others are perhaps to be placed in *Ceramioides*. *C. lichtensteini* (Klug) is a true *Ceramius*. On the other hand, *C. beyeri* Brauns combines some of the characters of *Ceramius* (middle tibiæ with two spurs and venter of the male unarmed) and *Ceramioides* (eyes very shallowly emarginate).

Paraceramius.—2 species in the Mediterranean Subregion, and 1 in Korea. The South African species listed by Bradley (1922, *Op. cit.*, p. 396) belongs in *Ceramioides*.

Ceramioides.—7 species in South Africa. Here should be placed *C. bicolor* (Thunberg) (=*C. karrooensis* Brauns), *C. consobrinus* H. de Saussure, and *C. linearis* Klug (of which *C. fumipennis* Brauns is a synonym according to information received by letter from Dr. H. Brauns).

Jugurtia.—4 species in the Mediterranean Subregion (as far as Transcaspia and Persia) and 1 species in Gambia. The British Museum collection contains two specimens from

[1]Through a curious oversight, Tillyard (1928, 'The Insects of Australia and New Zealand,' p. 296) calls these Australian masarids *Euparagia*, which is the name of a strictly North American genus not belonging to the Masaridinae.

Northern Nigeria which may belong to an undescribed species.

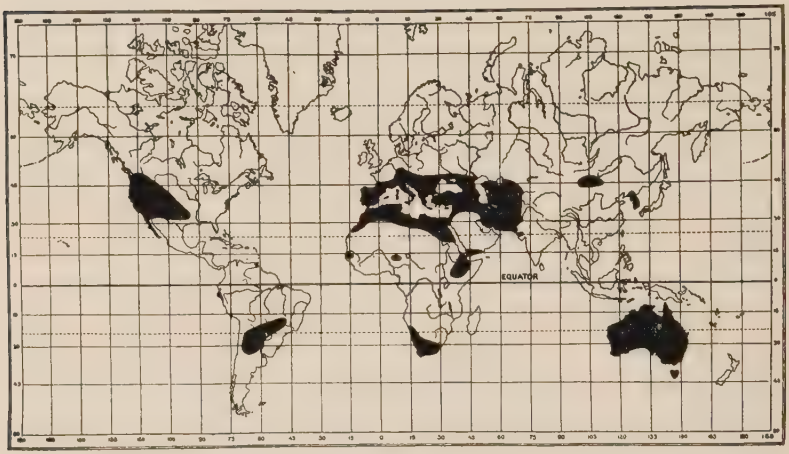

Fig. 2. Map showing the distribution of the subfamily Masaridinæ.

Celonites.—9 species in the Mediterranean Subregion (as fas as Turkestan; one of these species has also been recorded from southern Arabia), 1 in northwestern India, 2 in East Africa (Obock, Abyssinia, and northern Kenya Colony), and 7 in South Africa.

Quartinia.—4 species in the Mediterranean Subregion, 1 in Mongolia, 1 in northwestern India, and 2 in South Africa.

Masariella.—5 species in South Africa.

Masaris.—4 species in the Mediterranean Subregion (as far as Turkestan).

Pseudomasaris.—14 species in the western United States, from the southern part of British Columbia to Lower California and eastward to Colorado and Texas.

In appraising the endemicity of the several genera, one should be aware of the fact that they are of unequal value.

According to their natural affinities they may be grouped as follows:

(1) *Paragia* and *Metaparagia* occupy an isolated position in the subfamily and have rightly been separated by Bradley (1922 *Op. cit.*, p. 388) as a distinct tribe, Paragiini. They are restricted to the Australian Region, where no other masarids are known to occur.

(2) *Ceramiopsis* is strictly Neotropical.

(3) *Trimeria* and *Microtrimeria* are also strictly Neotropical.

(4) *Ceramius, Paraceramius,* and *Ceramioides* are extremely closely allied and should perhaps be regarded as of subgeneric value only. This group is Palæarctic and South African.

(5) *Quartinia* is found in the Palæarctic Region and in South Africa.

(6) *Jugurtia* and *Celonites* are Palæarctic and Ethiopian.

(7) *Masaris, Pseudomasaris,* and *Masariella* are Palæarctic, Nearctic and South African.

A study of the map brings out the interesting fact that the distribution of the Masaridinæ does not fit in the customary scheme of zoögeographical regions based upon the terrestrial faunæ as a whole. On the contrary, these wasps are restricted to a series of disconnected areas, often of relatively small extent and separated by extensive tracts of country where they are entirely lacking. A wide and discontinuous distribution of that type is generally explained on the theory that it is the remnant or result of a more extensive and more or less continuous area occupied by the group or its immediate ancestors during former geological periods. In the case of the Masaridinæ no paleontological evidence can be adduced in support of this view, and we must rely entirely upon analogy of their present-day distribution with that of certain other animals where such evidence is available. Three analogous cases may be briefly

mentioned. The present distribution of the Masaridinæ is almost exactly matched by that of the dipterous family Nemestrinidæ, which is known with certainty from the Miocene and may even have existed during the Jurassic[1]. The living Onychophora (*Peripatus* and allies) exhibit a distribution of a somewhat different type, yet distinctly composed of disconnected areas (See the map given by C. T. Brues, 1923, American Naturalist, LVII, p. 211); their extreme antiquity has been demonstrated by the discovery of one species in the middle Cambrian rocks of North America, although the group is no longer found living in that part of the world. The marine genus *Pleurotomaria* is one of the oldest groups of Gasteropoda: over 400 species are known from Palæozoic rocks, from the Cambrian on, and it was also abundant during the Jurassic; it was much rarer during the Tertiary; in the modern seas it is represented by only five or six living species, two in the Antilles, two or three in Japan, and one in the Moluccas.

A closer examination of the distribution of the Masaridinæ brings out some other items of interest. In the Palæarctic Region, these wasps are almost restricted to the Mediterranean Subregion which possesses 27 species of six genera: *Ceramius*, *Paraceramius* (endemic), *Jugurtia*, *Quartinia*, *Celonites*, and *Masaris* (endemic). Only one species, *Celonites abbreviatus* (Villers), extends into Central Europe, being found in Austria, Switzerland, and southern Germany (northernmost locality: Weissenfels near Leipzig, in about 51° N. lat.). *Quartinia* and *Celonites* are each represented by one species in the extreme northwestern corner of India, a region which may be regarded as an extension of the Mediterranean Subregion. Otherwise the subfamily is absent from the Oriental Region. One species of *Quartinia* has been described from Mongolia and one species of *Paraceramius* from Korea, both these areas belonging to the Palæarctic Region.

In the Ethiopian Region, South Africa is unusually rich,

[1] *Prohirmoneura jurassica* Handlirsch, described from the lithographic chalk (Malm) of Bavaria, is undoubtedly a nemestrinid. Yet, as it was based upon a single specimen, I feel somewhat doubtful of the correctness of the geological horizon to which it was referred.

with 28 species of five genera: *Ceramius, Ceramioides* (endemic), *Quartinia, Celonites,* and *Masariella* (endemic). The vast majority of these forms occur south of the Orange River; a few extend into the Orange Free State (to 29° S. lat.) and South West Africa (to 22° S. lat.). The three remaining Ethiopian species, of the genera *Jugurtia* and *Celonites,* are found in the Sudan (Gambia and Northern Nigeria) and in East Africa (Obock, Abyssinia, and Kenya Colony. The occurrence of one species of *Celonites* in southern Arabia should be mentioned here since that territory belongs zoögeographically to the Ethiopian Region. It is significant that the masarids avoid the West African Subregion and the Malagasy Region.

The 24 species of the Australian Region all belong to the endemic genera *Paragia* and *Metaparagia* and are restricted to the Australian continent and Tasmania.

Only 8 species are known from the Neotropical Region, all belonging to three endemic genera: *Ceramiopsis, Trimeria,* and *Microtrimeria.* They occur in the arid or semi-arid parts of South America, avoiding entirely the tropical, moist, densely forested areas.

The Nearctic Region has 14 species, all belonging to one endemic genus, *Pseudomasaris,* the distribution of which has been indicated above. Its northernmost occurrence is at Princeton, British Columbia, in about 49° 30′ N. lat.

The present-day localisation of the Masaridinæ in certain well-defined areas seems to be entirely due to the ecological conditions favored by these wasps. The overwhelming majority of the species occur in arid or semi-arid country only, or at least in regions characterized by a hot and relatively dry summer. These wasps may therefore be called xerophilous. They entirely avoid regions with a heavy and evenly distributed rainfall, whether in temperate or in tropical parts of the world. These ecological requirements, as well as the strictly vegetarian habits, also explain why most masarids are among the rarest of insects. In order to perpetuate the species, the adults must appear at the proper season, when the flora is at its best. This condition is, of course, entirely regulated by the rains, which in desertic and semi-arid regions are always of short duration and

often erratic. Thus in the South African Karroo two or more years may pass without rain. As H. Brauns has shown (1911, *Op. cit.*, p. 446), the larvæ of *Ceramius* have the faculty of remaining in their underground cells without pupating throughout these long dry spells. In moister years, however, the adults are ready to hatch in early spring. As there are many arid parts of Central Asia, Arabia, the Sahara, and South America that have never been visited at the proper season by an entomologist, it is safe to prophesy that several species and perhaps even genera of masarids remain to be discovered. It is doubtful, however, whether future finds will materially alter the discontinuous distribution of the group, as known as present.

The Masaridinæ as an Archaic Group

It has been sometimes assumed that the masarid wasps are an archaic, or primitive, group of Vespidæ, but, so far as I know, no definite arguments have been brought forward in support of this opinion. I believe that this view, although correct in some respects, ought to be qualified, as I shall attempt to show presently.

The detailed discussion of the morphology of these wasps, given above, makes it clear, I think, that in almost every character of phylogenetic importance the Masaridinæ are either not more primitive than most other subfamilies of Vespidæ, or have retained primitive conditions in certain genera while being highly specialized in others. The most striking features of the masarid wing, *viz.*, the presence of only two closed cubital cells in the fore wing and the apparent lack of a discoidal vein in the hind wing, are evident specializations. As for the plaiting of the fore wing, it is indicated in certain species and it is as clearly marked in *Celonites* and *Quartinia* as in *Vespa*. The highly modified mouth-parts likewise preclude the possibility that the present-day Masaridinæ are anything like the ancestral stock of all the Diploptera. As a matter of fact the Gayellinæ and Euparagiinæ are in many features more primitive than the Masaridinæ, since they still have unplaited fore wings with three closed cubital cells, the second and third each receiving

a recurrent vein, while the hind wings have a distinct or large posterior lobe and at least a trace of a discoidal vein; in addition their trophi are not modified into a proboscis.

I am therefore unable to regard the Masaridinæ as a primitive or ancestral group. Nevertheless, they undoubtedly constitute an archaic unit, not derived from the immediate ancestors of the other subfamilies of Diploptera nor ancestral to them, but forming a very ancient, autochthonous line of descent. I am inclined to the view that at least five distinct, or independent, lines of descent may be recognized among the living Vespidæ, as follows:

(1) Subfamily Gayellinæ *(Gayella* and *Paramasaris).*

(2) Subfamily Euparagiinæ *(Euparagia).*

(3) Subfamily Masaridinæ.

(4) Subfamily Vespinæ *(Vespa* and *Provespa).*

(5) The remainder of the Vespidæ, comprising the subfamilies Polistinæ, Ropalidiinæ, Polybiinæ, Raphiglossinæ, Zethinæ, Eumeninæ and Stenogastrinæ.

As in many other ancient groups, that have persisted through long geological periods and have thus had time to mature, the Masaridinæ often exhibit extraordinary structural characters. They are the delight of the taxonomist and, in this respect, contrast sharply with the other Diploptera, the morphology of which is only too often of a despairing monotony. Most of the peculiar structures of the masarids are exaggerated secondary sexual characters of the males, the usefulness of which to the species is extremely doubtful or at least not apparent. These characters affect the shape of the antennæ, legs and abdominal segments. Sexual dimorphism is often so pronounced that the specific or even the generic connection between the two sexes is quite a problem.

One of the most convincing arguments in favor of the great antiquity of the Masaridinæ as a distinct subfamily, is their present-day discontinuous distribution, as I have sufficiently indicated above. One remarkable feature still should be mentioned, namely the absence of any close

relationship between the masarids of Australia, South Africa, and South America respectively. This group evidently gives no support to the partisans of land connections between these continents during late Mesozoic and Tertiary times.

In view of the highly specialized modification of the trophi into a proboscis correlated with strictly vegetarian habits, one may venture the hypothesis that the Masaridinæ represent an early attempt at evolving an anthophilous group of aculeate Hymenoptera, perhaps anterior to the evolution of the Apoidea (or bees) from a sphecoid stock. It may be supposed that during some former geological periods, these wasps were a predominant group, perhaps holding the same important position in the ecology of the phanerogams as is nowadays reserved to the bees. Their eventual decline, resulting in their present-day scarcity and discontinuous distribution, may have been brought about by the rising competition of the Apoidea, whose branched hairs and highly efficient collecting apparatus gave them considerable advantage as pollen gatherers and feeders over the masarid wasps.

TWO NEOTROPICAL ANTS ESTABLISHED IN THE UNITED STATES.

By William Morton Wheeler.

In a recent number of the Journal of Economic Entomology[1] Mr. M. R. Smith called attention to two Neotropical ants, *Iridomyrmex iniquus* Mayr and *Wasmannia auropunctata* Roger, as occurring in the United States. The former was found inhabiting the greenhouse of the University of Illinois, the latter was taken out of doors at Miami, Florida.

The Iridomyrmex has been a denizen of the greenhouses of the Bussey Institution for at least the past twenty years, as I noticed its occurrence soon after I moved to Boston in 1908. The specimens do not, however, belong to the typical form of the species but to the var. *nigellus* Emery, originally described from Costa Rica. They were probably introduced in soil with tropical plants some years prior to 1908. Although the green-houses have been fumigated on several occasions with calcium cyanide for the purpose of ridding them of plant pests, the ant has always managed to survive and is now as abundant as ever. Our gardener regards it as a nuisance. He has found it visiting the flowers of strawberries used in hybridizing experiments and suspects it of cutting out the anthers. Its principal food, however, is the honey-dew of Coccids, as Mr. Smith has observed. The small nests are made in the thin layer of soil on the benches under the pots and contain glistening white larvæ at all seasons of the year. I have taken the males and winged females in March.

Wasmannia auropunctata, a very common ant throughout Central and northern South America, the West Indies and the warmer portions of Mexico, is cited by Mr. Smith from Miami, Florida. That it is established in tropical Florida is indicated also by the fact that some five years

[1]Vol. 22, 1929 p. 241-243.

ago Dr. David Fairchild sent me a number of specimens that had been taken by his daughter, Miss Nancy Fairchild, at Cocoanut Grove, Florida, with the comment that their stings were painful. This ant is often abundant in the coffee plantations of Porto Rico where it is known as the "hormiguilla" and proves to be very annoying to the berry-pickers. It is not infrequently transported to northern ports with orchids and other tropical plants. I possess a series of workers and winged females taken by Mr. F. B. Shaw in orchids from Colombia at quarantine in New York City, and Donisthorpe[1] has the following remarks on its occurrence in England: "I first discovered this very small species in Kew Gardens in 1907; it is one of the commonest ants at Kew, being abundant in the propagating pits and some other houses. It nests in and under flower-pots, in the leaf-sheaves of *Piper obliquum* v. *eximium*, etc. and its males and females, which are very large in comparison with the workers, occur in December and January in the nests, and sometimes on the walls of the hot-houses. A small "woodlouse" somewhat like *Platyarthrus hoffmanseggi*, and the little spider *Diblemma donisthorpei* Camb., which is superficially very like the worker ants, are usually found in the nests. In 1922 Halkyard took it in a banana store in Manchester."

While it is probable that both the *Iridomyrmex* and the *Wasmannia* may eventually become established in greenhouses in many parts of the United States, they will be able to survive out of doors only in the very restricted tropical portions of the country.

[1]British Ants, 2nd ed. 1927 p. 393.

NOTE ON GESOMYRMEX

By William Morton Wheeler

Since the manuscript of my paper on the interesting, Javanese ant, *Gesomyrmex kalshoveni,* was sent to the printer, Dr. Kalshoven has kindly sent me the remainder of the colony which contained the type specimens, together with a note on the precise situation of the nest. He writes: "The new Gesomyrmex was found in a branch of an *Artocarpus elastica* ("bendo") in a stand of various deciduous trees—relics of the old natural mixed forest—amidst the teak-forests of Semarang." This statement confirms my supposition in regard to the habits of Gesomyrmex, which evidently lives much like many twig—or branch—inhabiting Camponoti of the subgenera Myrmentoma, Colobopsis, Pseudocolobopsis, Hypercolobopsis, Myrmocladœcus and Myrmobrachys. That the specimens collected by Dr. Kalshoven were living in a piece of primitive forest is of some interest in connection with the fact that the extant species of Gesomyrmex are sporadic survivors, or relicts of an ancient ant-fauna of much wider distribution during the Oligocene Tertiary.

The second lot of specimens from Dr. Kalshoven comprises in addition to 13 workers (one maxima, five mediæ and seven minimæ), which show the same range of polymorphism as described and figured for the first lot, also one male semipupa and two female pupæ. The male semipupa reveals nothing new, but the two female pupæ are interesting. They are approaching maturity since their eyes and mandibular teeth show the beginnings of pigmentation. Both are naked, i.e. not enclosed in cocoons, and measure about 10 mm. They closely resemble the female of *G. luzonensis* Wheeler from the Philippines, but have distinctly smaller eyes and a much shorter petiole, with less

[1]See Psyche, vol. 36, p. 1 (1929)

rounded and more anteroposteriorly compressed node. The antennæ are 10-jointed as in *luzonensis,* with the funicular joints 3-8 broader than long. The thorax seems to be stouter and shorter than in the species from the Philippines, but the integument is still so soft, that I can infer nothing in regard to the adult proportions of its various sclerites.

A FLIGHT OF *PIERIS MONUSTE*

I was much interested in the account by Dr. E. D. Ball and W. E. Stone of "A puzzling Butterfly Migration" (Science, vol. 68, p. 110, 1928). It reminds me of a migration which occured while I was living at St. Augustine, Florida. In June, 1881, there was a northward flight of *Pieris monuste* lasting for three days. On the first and second days it was a marvelous sight like a snowstorm with large flakes obscuring the view. On the second day a New York schooner ("Nellie Grant") came in. I knew the captain quite well and asked him when he first saw the flight and he said—"Yesterday afternoon about ten miles off shore." It was the first and only flight I saw during the eight years I lived in Florida, and was noticed at the time as far north as Charleston, S.C. Many asked me the cause of this great flight. I attributed it to a search of the insect for more food plants. There are many cruciferous plants along the sea-coast that are often destroyed by the larvæ. The first brood having devoured all the food plants of the species along the more southern part of the Florida coast, the second brood was compelled to migrate, and in this case it was northward.

This flight was recorded in the American Naturalist, Vol. 15, p. 577, 1881. The report was from Bluffton, near Beaufort, S.C., and occurred June 1 and 2. They were flying "East or northeast." As they were apparently following the coast, this would naturally be the direction they would be flying east of Savannah.

C. W. Johnson.

A SPECIES OF *MEGACHILE* FROM BERMUDA[1].

By Theodore B. Mitchell

A single female *Megachile,* captured during May, 1913, by Mr. Austin Brues in Bermuda, and sent to me by Dr. Bequaert for identification, proves to be either a variety of *M. pruina* Sm. or a very closely related species. Hence I will describe it here as a new variety of that species. If the male becomes available at some future time, it is possible that this will be shown to be specifically distinct from *pruina.*

Megachile pruina bermudensis n.var.

Size: Length 13 mm.; breadth of abdomen 5 mm.; anterior wing 9 mm.

Structure: Head broad; eyes slightly converging below; clypeus entire apically, the margin slightly thickened and shining medially; mandibles 4-dentate; cheeks as broad as eyes; vertex flat, hind margin slightly concave; lateral ocelli slightly nearer edge of vertex than to nearest eye; basal joint of flagellum longer than the second joint; hind metatarsi almost as long and as broad as the tibiæ; abdomen cordate, the apical margins of the segments rather strongly depressed laterally, but not medially; segment six straight in profile, slightly concave at sides in dorsal aspect, with only suberect black hairs visible in profile, the ventral plate bare except for a marginal fringe of black hairs, the apical margin extending as a bare lip beyond the apical fringe.

Puncturation: Close on cheeks and pleura, and on clypeus except in center; on the vertex close on either side of the median line, more sparse laterally; distinctly separ-

[1]Contribution from the Department of Zoology and Entomology, North Carolina State College, and published with the approval of the Director of the North Carolina Experiment Station as Paper No. 31 of the Journal Series.

ated on mesonotum medially, but close laterally and anteriorly, and quite widely separated on scutellum; fine and close on basal abdominal segment, becoming relatively coarse and sparse on segment five, close and fine on segment six.

Color: Black; the tegulæ and antennæ below more fuscous; the wings quite uniformly infuscated, with fuscous nervures; spurs pale yellow.

Pubescence: White at sides of face, between antennæ, on cheeks, pleura, propodeum, coxæ, femora, tibiæ, and basal abdominal segment; black on vertex, mesonotum, scutellum, and discs of abdominal segments 2-5, with intermixed black hairs between antennæ; more fuscous on clypeus, front tibiæ and tarsi anteriorly, and on outer face of mid tarsi; segments 2-5 with narrow entire white apical fasciæ; segment six whitish tomentose, with erect black hairs laterally, these subappressed medially; scopa white, black on segment six and at extreme sides of segment five.

Type: Female; Bermuda. Coll. Austin Brues. (Museum of Comparative Zoölogy, Cambridge, Mass.).

This differs from typical *pruina,* as occuring in Florida, in the more lightly infuscated wings, and in the fact that the scopa of segment five is largely white. In *M. pruina* s. str. the scopa of segment five is entirely black, and that on segment four is black at the extreme sides. Otherwise, they are nearly identical. *M. pruina* was also described by Cresson as *M. pinguis.* The male was described by Robertson as *M. floridana,* and by myself as *M. shermani.*

THE ANT GENUS RHOPALOMASTIX[1]

By William Morton Wheeler

The genus Rhopalomastix was established by Forel in 1900 for a very aberrant female Myrmicine ant (*Rh. rothneyi*) taken by G. A. J. Rothney at Barrackpore, near Calcutta, India[2]. In 1911 he detected the worker and male of this species and also the female of a second species or subspecies *(Rh. escherichi)* among the ants collected by Prof. K. Escherich in Ceylon[3], and was therefore able to recognize the close relationship of the genus to Melissotarsus Emery, which now comprises four species, confined to the Ethiopian and Malagasy Regions, namely, *M. beccarii* Emery from Erythrea and Natal, *emeryi* Forel from southern Ethiopia, with a var. *pilipes* Santschi in East Africa, *weissi* Santschi from the Congo and *insularis* Santschi from Madagascar. In both genera, which together now constitute the tribe Melissotarsini, the antennæ of the worker are very short, with much enlarged terminal joint, the frontal carinæ are closely approximated and resemble those of certain Ponerinæ (Ponera), the thoracic dorsum is sutureless and the tibiæ of the middle and hind legs are spurless. The wings of the male and female lack the discoidal cell, and have a long cubital and a closed and appendiculate radial cell. The antennæ of the males are 12-jointed in both genera, but the worker of Melissotarsus has the antennæ composed of only 6 joints, whereas there are 10 in Rhopalomastix. Melissotarsus is also peculiar in possessing conspicuously dilated basitarsal joints on all the legs. Emery[4] believed that the worker of *M. beccarii* was distinctly dimorphic, or repre-

[1]Contributions from the Entomological Laboratory, Bussey Institution, Harvard University, No. 313.

[2]Forel, A. Un nouveau genre et une nouvelle espece de Myrmicide. Ann. Soc. Ent. Belg. 44, 1900, p. 24-26.

[3]Forel, A. Ameisen aus Ceylon. In K. Escherich's "Termitenleben auf Ceylon", 1911 pp. 215-228.

[4]Emery, C. Catalogo delle formiche esistenti nelle collezioni del Museo Civico di Genova. Part I. Anal. Mus. Civ. Genova 9, 1877 p. 378-379, fig.

sented by a soldier phase (Fig 2) with anteriorly broad head and convex blunt-toothed mandibles and a worker phase proper with anteriorly narrower head and acute mandibles, but Arnold[5], who examined a long series of this species, finds a complete gradation between the two forms.

Several years ago Viehmeyer sent me eleven workers and two immature males of a Rhopalmoastix belonging to a series taken by H. Overbeck at Singapore. Viehmeyer[6] had recorded them as belonging to *Rh. rothneyi,* but on comparing them with Forel's description I find that they differ in size and coloration and therefore probably represent a distinct subspecies, which is here described:

Rhopalomastix rothneyi Forel subsp. **johorensis** subsp. nov.

Worker. Length 2 - 2. 6 mm.

Distinctly larger than the typical *rothneyi,* which measures only 1.7 - 1.8 mm. Head scarcely longer than broad (1 1/6 longer than broad in *rothneyi*) and with somewhat smaller eyes (13 to 15 facets, instead of about 20). Head and thorax rich ferruginous red; appendages, abdomen and sides and declivity of epinotum clear brownish yellow.

I have recently received another series of specimens, comprising all three phases of a second subspecies of *rothneyi* from Java, which may be described as:

Rhopalomastix rothneyi subsp. **javana** subsp. nov. (Fig. 1)

Worker. Length 1.3-1.8 mm.

Averaging smaller than the typical form of the species. Head not longer than broad; thorax shorter, only 1 2/3 times as long as broad, with the epinotum distinctly narrower than the promesomotum. Median tooth of the anterior clypeal border very indistinct. Eyes smaller, consisting of only 12 to 14 facets. Sculpture finer than in the subsp. *johorensis;* color similar, but the head and thorax more yellowish ferruginous, the gaster clouded with brown apically.

[5]Arnold, G. A Monograph of the Formicidæ of South Africa, Ann. South Afr. Mus. 1916 p. 188 nota.

[6]Viehmeyer, H. Ameisen von Singapore. Arch. Naturg. 81, (1919) 1916 p. 108-168, 15 figs.

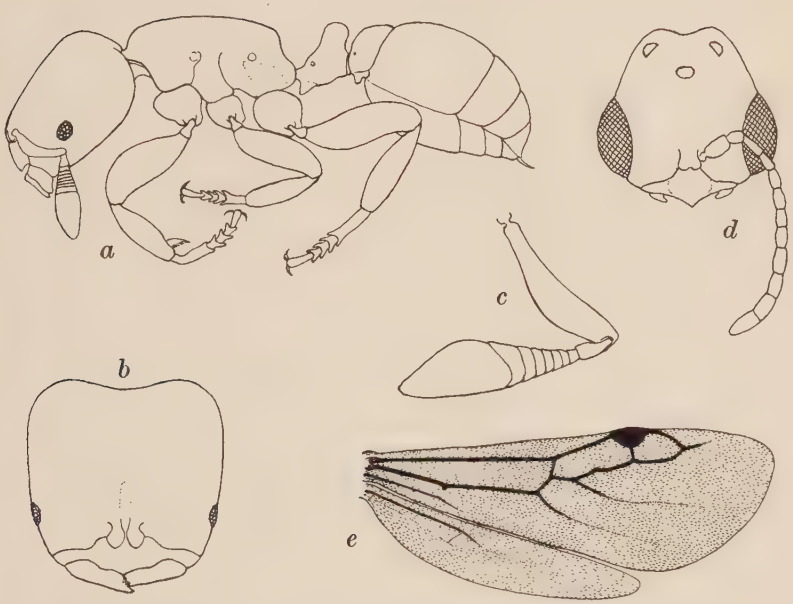

Fig. 1. *Rhopalomastix rothneyi* Forel subsp. *javana* subsp. nov. *a*, worker in profile; *b*, head of same, dorsal view; *c*, antenna of same; *d*, head and antenna of male; *e*, wings of same.

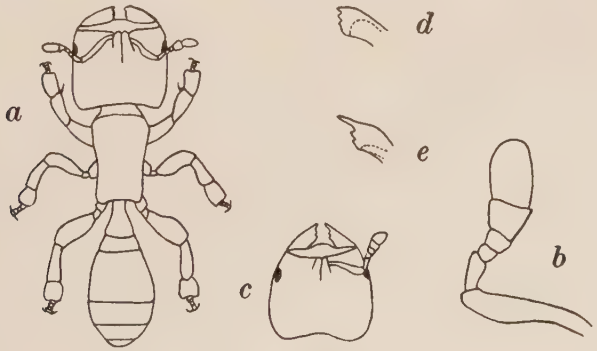

Fig. 2. *Melissotarsus beccarii* Emery. *a*, broad-headed worker, dorsal view; *b*, antenna of same; *c*, head of narrow-headed worker (After C. Emery); *d*, mandible of broad-headed worker; *e*, mandible of narrow-headed worker (After G. Arnold).

Female (deälated). Length 2.5-2.8 mm.

Antennæ 10-jointed as in the worker. Deep castaneous brown; pronotum, thoracic sutures, pedicel and appendages paler, more reddish brown. Sculpture as in the typical *rothneyi,* the anterior third of the head and the thoracic dorsum very finely longitudinally striated, the posterior portion of the head shining, sparsely and rather coarsely punctate, the gaster shining, with finer, piligerous punctures.

Male. Length 2-2.3 mm.

Black, with brown appendages. Wings clear and hyaline, with dark brown veins and pterostigma, the latter small and subelliptical. The costal vein is absent basal to the pterostigma and there is a distinct indication of a former division of the long cubital cell into two cells and pale indications of former prolongations of the cubitus and discoidal veins towards the tip of the wing. The hind wing is narrow and has only one distinct vein, the media.

Described from numerous workers, four females and three males taken at Bondowoso, Besoeki, Eastern Java and received from Dr. L. G. K. Kalshoven.

My female specimens of *javana* do not agree with Forel's description of the typical *rothneyi* in the number of antennal joints. In his generic diagnosis he gives the number as 11, which is also the number given by Emery in the "Genera Insectorum," but in my specimens the number is certainly 10. Probably Forel did not examine balsam mounts, without which it is impossible to determine the precise number of the very short and crowded median joints of the funiculus. That both worker and female of Rhopalomastix have the same number is also indicated by the conditions in Melissotarsus, both the female phases of which have 6-jointed antennæ.

Apart from the complete absence of spurs on the middle and hind tibiæ, the legs of Rhopalomastix also show peculiarities in the structure of the worker and female tarsi, which are by no means of the "common form" as stated by

Forel. To be sure, the basitarsi are not dilated as in Melissotarsus, but the second to fourth joints are unusual in being extremely short, obliquely prolonged on each side and overlapping.

In regard to the palpal joints, I am unable to add anything to Forel's statement that in the worker the "labial palpi are two-jointed, the maxillary palpi not to be found." Perhaps the latter are present but greatly reduced.

The peculiarities of the wing-venation are inadequately described by Forel. As will be seen from Fig. 1e, the fore wing is peculiar in completely lacking the costal vein basal to the pterostigma, in the shape of the pterostigma, and the length of the cubital cell which exhibits traces of a division into two. Forel compares the venation with that of Solenopsis, but it is clearly more like that of Myrmecina, especially in the structure of the radical cell. According to Arnold, the apterostigma is almost obsolete in Melissotarsus.

Both the genera of Melissotarsini have essentially the same nesting habits, as shown by the following notes. Escherich took all phases of the typical *Rh. rothneyi* under bark. Viehmeyer cites Overbeck as having taken the form which I have described as the subsp. *johorensis* from several nests in the dead twigs of mango (Mangifera) and in the bark of durion trees *(Durio zibethinus),* and Dr. Kalshoven has sent me the following note in regard to the subsp. *javana:* "The Rhopalomastix (g104) was collected from a sample of bark of a dying *Mangifera indica,* which was forwarded to our Institute at Buitenzorg by Dr. Loos, the landbouwconsulent (agricultural expert) at Bondowoso (Res. Besoeki, Eastern Java). Dr. Loos wrote us that the ants were burrowing in the bark of the dying tree. The bark was riddled by the insects over half the circumference of the tree and at least as high as he could reach. Numerous pupæ were seen. The ants, however, were not considered to be the cause of the death of the tree." This note shows that the Rhopalomastix colonies may be very populous. That Melissotarsus has very similar habits may be inferred from Arnold's remark (p. 190) on *M. beccarii,* which was taken at Durban, "nesting under bark in moderately populous colonies."

The affinities of the Melissotarsini to other tribes of Myrmicinæ are very obscure. Forel at first regarded Rhopalomastix as allied to Solenopsis, but on receiving the worker at once recognized its close relationship to Melissotarsus. He believed, however, that "both genera are undoubtedly primitive Myrmicines, allied to the Ponerine group Cerapachyi." In view of the extraordinary specialization of the structural characters in both genera of Melissotarsini, this relationship can hardly be maintained. It was evidently suggested by purely superficial resemblances in general habitus to forms like Cylindromyrmex, Simopone, etc. which also burrow in wood. Emery, who had carefully studied Melissotarsus, when he came to revise the classification of the Myrmicinæ for the "Genera Insectorum" (1921 p. 8) confessed his inability to establish the affinities of the Melissotarsini and a few other aberrant Myrmicine genera. He says: "Myrmicaria, Stereomyrmex, Cardiocondyla and especially the Melissotarsini are very specialized and isolated ants. In the present state of Myrmecology it is absolutely impossible to say anything about their affinities. I am of the opinion that the Melissotarsini are very primitive, but profoundly adapted to particular conditions of existence (thorax without sutures, antennæ, lack of spurs, very small size, etc.). At any rate this group is very aberrant." In the "Genera Insectorum" Emery placed the Melissotarsini next to the Stereomyrmicini, which they somewhat resemble. In my opinion there are also vague affinities between the Melissotarsini and the Myrmecinini, especially in the wing-venation and the structure of the head of the male, though the mesonotum of the male Myrmecina possesses notauli which are absent in the Melissotarsini.

In all probability the Melissotarsini, which now comprise only half a dozen species, are the last survivors of some very ancient Myrmicine stock. Their antiquity is attested by their rare and sporadic occurence in a rather circumscribed geographic area. Evidently the Indomalayan genus Rhopalomastix is more primitive than Melissotarsus, which is known only from the warmer parts of Africa and Madagascar. In both genera, however, the characters of the worker, particularly the diminutive size, compact, subcylindrical

shape of the body, the small eyes, reduced palpi, short, stout appendages, the flattened, club-like antennal funiculi, the peculiar shape of the mandibles and the coloration, all reminiscent of similar characters in the Scolytid and Platypodid beetles, represent so many specialized adaptations to a burrowing life in bark and dead wood. The tribe is, therefore, like certain tribes of Ponerine and Formicine ants and certain vertebrates such as the sturgeons among fishes, the ostriches among birds and the monotremes among mammals, a group of ancient but highly specialized and conservative species which have managed to survive in a narrow, constant environment.

A NOTE ON THE ASPARAGUS BEETLE, *CRIOCERIS ASPARAGI* LINN.

In the summer of 1928 I examined some small apple trees planted in an asparagus bed in North East, Erie Co.,Pa. Great numbers of the asparagus beetle, *Crioceris asparagi* Linn., were present on the asparagus, and a large number of both sexes were resting and crawling about on the trunks and branches of the apple trees. Several rows of peach trees were also set in the asparagus bed, but I could find no beetles upon them, although the insects were apparently as numerous on the asparagus between the peach trees as on that between the apple trees. No eggs of the beetle were found on the apple trees, the insects apparently only resting on the trees. Since the beetle is strongly positively phototropic, the fact that the apple trees were open with their branches shaded very little from the sunlight, while the trunks and branches of the peach trees were shaded by foliage, may, perhaps, account for the seeming preference of the asparagus beetle for the apple trees as resting places.

MILTON F. CROWELL.

A CAMPONOTUS MERMITHERGATE FROM ARGENTINA

By William Morton Wheeler

In a recent paper[1] I called attention to the different effects produced by Mermis parasitism in female ants belonging to different castes and natural subfamilies. When the queens of Lasius species (subfam. Formicinæ) are infected and converted into mermithogynes, the observable effects are a slight diminution in the size of the head and thorax and a pronounced diminution in the size of the wings. In various genera of Ponerinæ (Euponera, Pachycondyla, Odontomachus) the mermithized workers, or mermithergates, have the head narrowed, small ocelli may be developed and some of the other parts of the body may come to resemble those of the queen. In the genus Pheidole (subfam. Myrmicinæ), which has three distinct female castes—queen, soldier and worker—the infected individuals usually present a peculiar blending of the characters of all three phases. The only recorded example of a mermithized worker Formicine ant is a specimen of the large *Camponotus (Tanæmyrmex) pompejus* Emery subsp. *cassius* Wheeler, which I described from the Belgian Congo. This specimen was unmodified and, apart from the swollen gaster containing the coiled Mermis, had all the characters of a normal worker minor.

While studying the large collection of ants made by Prof. J. C. Bradley during 1919-20 in South America, I have found another mermithized worker Formicine, which is more interesting than the Congolese specimen. This is a specimen of *Camponotus* (*Tanæmyrmex*) *punctualatus* Mayr. subsp. *minutior* Forel, a common ant in the Argentine and represented in Professor Bradley's collection by several series of major and minor workers taken at Laguna Paiva, Posadas, La Quiaca, San Juancito and Coquin. The mermithergate was taken in the locality last mentioned, which is in the

[1]Mermis Parasitism and Intercastes among Ants. Journ. Exper. Zool. 50, 1928 pp. 165-237, 17 figs.

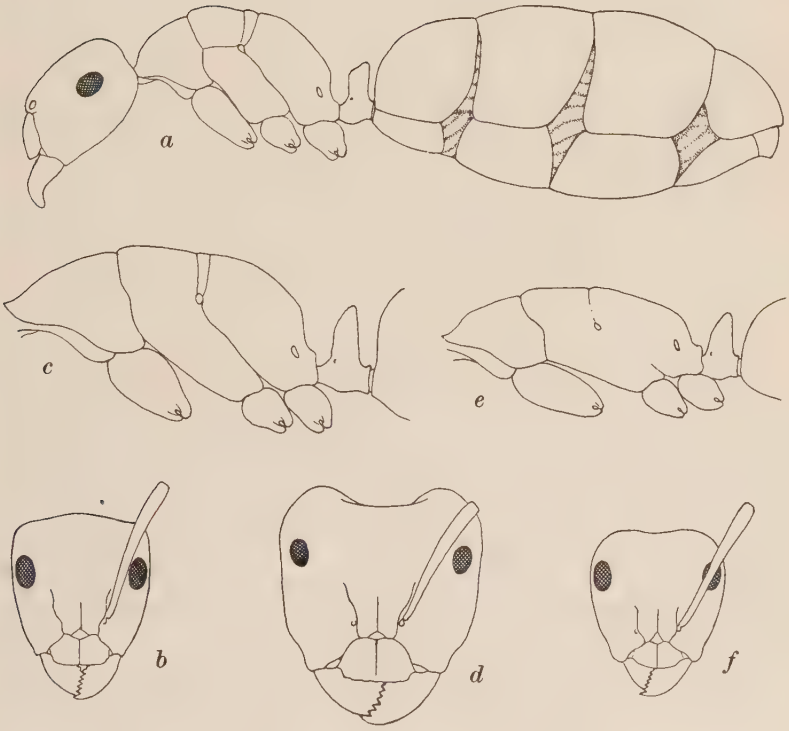

Fig. 1. *Camponotus (Tanœmyrmex) punctulatus* Mayr subsp. *minutior* Forel. *a,* mermithergate, in profile; *b,* head of same, dorsal view; *c,* thorax and petiole of normal worker maxima; *d,* head of same; *e,* thorax and petiole of normal worker minima; *f,* head of same.

Sierra de Cordoba. *C. punctualatus* is a highly variable species of which some 16 subspecies and varieties have been described, ranging over Argentina, Patagonia, Bolivia, Peru and Southern Brazil (Rio Grande do Sul and Sao Paulo). One variety, *pergandei* Emery, is recorded from Mexico.[1]

The normal worker major of *C. punctulatus minutior* (Fig. 1, *c* and *d*) measures 6-7.5 mm., the worker minor (Fig. 1 *e* and *f*) 3.5-5 mm., the fertile female, or queen 11 mm. (according to Mayr.). I have not seen specimens of the queen *minutior*, but there are in my collection specimens of this caste belonging to the typical *punculatus* and its subsp. *andigena* Emery from Argentina, Bolivia and Peru. Both of these differ from the subsp. *minutior* only in size, sculpture and pilosity and in having the head, thorax and petiole black instead of red or reddish brown.

The mermithergate (Fig. 1*a*) measures 7.3 mm. Its head *(b)* is much smaller than that of the worker major *(d)* and shaped more like that of the queen than the worker minor *(f)*. This is especially true of its occipital region. There are no ocelli on the vertex, but these are small and widely separated in the queen. The mandibles are more convex than in the worker minor and therefore more like those of the major and queen. The clypeus, too, in possessing a more pronounced subrectangular anterior lobe is of the queen and worker major type. On the other hand, the antennal scapes of the mermithergate are long and slender and extend well beyond the posterior corners of the head as in the worker minor, whereas the scapes of the major and queen are much shorter in proportion to the dimension of the head. The tho-

[1]As Santschi has shown (Ann. Soc. Ent. France 88, 1919 p. 386), Mayr's original description of C. *punctulatus* (Annuar. Soc. Nat. Modena 3, 1868 p. 161) was drawn from at least three different forms of the species, namely, the subsp. *minutior* (Forel 1886), with red head and thorax, the subsp. *imberbis* Emery var. *cruenta* Emery (1905), with black head and red thorax, and the form with black head and thorax, which Emery (1887) regarded as the type. Since Mayr mentions the form with *minutior* coloration first in his description of the worker and since the only female he describes belongs to this same form, the black form should have been given a new name and Forel's *minutior* regarded as a synonym of Mayr's *punctulatus*. It may be best, however, to leave this nomenclatorial adjustment to some future monographer of the species and its numerous subspecies and varieties.

rax, though very small, is more strongly convex and arched above than in either of the sterile castes. While it resembles the thorax of the queen, the sclerites, especially the mesonotum, are smaller, but this has distinct lateral sutures as in the queen. These sutures are absent in both major and minor workers, though sometimes indicated by faint lines in the former. There is a distinct metanotal sclerite in the mermithergate, of the same form as in the major (absent in the minor). The petiole is peculiar and apparently somewhat deformed anteriorly, though higher and broader than in the minor and therefore more of the major and queen type. The gaster is enormously distended (nearly 4 mm. long) with one or possibly several Mermis, the compact coils of which are visible through the thin, stretched, intersegmental membranes. The legs are slender, like those of the minor worker, but longer.

In its coarser sculpture, i. e., in the dense punctuation of the head and thorax, the mermithergate resembles the worker major and queen rather than the minor. The same is true of the conspicuous elongate punctures on the occiput, pro- and mesonotum. These are well-developed in the mermithergate as in the major, but obsolete in the minor. In the queen they are less developed than in the mermithergate. The pilosity of the latter is also like that of the major, i. e., more abundant than in the minor and less abundant than in the queen. The head and thorax of the mermithergate are decidedly less reddish and more brownish than in the two worker castes. In coloration it is therefore more like the queen, which Mayr describes as "rufa, capite postice opaco nigro, antice obscure castaneo-fusco, mandibulis castaneis, antennis læte castaneis, thorace supra subnitido castaneo, abdomine nitido nigro." This agrees well with the color of the mermithergate, except that its head is castaneous brown and not black posteriorly.

The *C. minutior* mermithergate above described is of more than usual interest on account of its close resemblance to the mermithized specimens of Pheidole in exhibiting a mixture of worker major, worker minor and queen characters in the structure of the head, thorax, petiole and appendages, instead of being an unmodified worker minor like

the *C. cassius* described from the Congo. If the hypothesis which I advanced in my paper of 1928 be accepted, the latter specimen may be supposed to have been infected by Mermis as an adult worker minor larva just before spinning its cocoon, whereas the *minutior* mermithergate was infected as a queen larva which had developed slightly beyond the stage at which, by some difference in feeding, it might have been converted into a normal worker major.

DIPTERA DESTROYING SNAILS

In a series of papers entitled "Natural History Notes from North Carolina" (Journ. Cincinnati Soc. Nat. Hist., vol. 17, p. 72, 1894), A. G. Wetherby under *Zonites elliotti* Redf. says: "This shell is destroyed by a parasitic larva, the imago of which is a small and active species of Diptera. The grown larva occupies the shell as a pupa house after devouring the inmate. I have noticed this habit of the Diptera in the case of but one other species, and that is *Polygyra fastigans* Say. At the only locality where I have collected this latter species, more than half the snails were affected, and the number of dead shells holding the empty pupa cases, were sufficient testimony to the activity of the parasite."

It would be interesting to know what this fly really is. A small Sarcophagid—*Helicobia helicis* Town. was bred from a snail—*Polygyra thyroidus* Say. I have always looked up this record as only accidental, for the fly is common and has been bred from a number of species of insects, and in many cases is considered a true parasite (Aldrich, "Sarcophaga and Allies in North America, pp. 158-161, 1916). Dr. J. Bequaert however, has described a Sarcophagid representing a new genus and species—*Malacophagula neotropica* from a snail—*Bulimulus tenuissimus* at Para, Brazil, which he considers a true parasite of the snail (Journ. Parasitology, vol. XI, pp. 201-212, 1925).

C. W. Johnson.

COMMON NAMES AND TAXONOMY[1]

By J. A. Hyslop

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Common names and taxonomy. That sounds almost like a paradox. The vulgar thoughts of the rabble and the profound cerebrations of the intellegentsia, but after all a name is a name, and, of course, the first names were vernacular.

Then scientific expendiency led to a system of technical nomenclature so that order might be brought out of chaos. Thus we were to have for each organism a name universally used and recognized, which would indicate phyletic relationship. Undoubtedly Linneaus saw in his work the initiation of a stable system. It is well that we visit this world but once!

Of course, I am in sympathy with the rules of binomial nomenclature and believe that *nomina conservanda,* in taxonomy are diametrically opposed to the laws of priority and the principles of natural classification.

Therefore the vernacular name, despite its myriad colloquial modifications, remains our only hope for immediate stability. But even here we are beset with almost insurmountable difficulty: the roadside grasshopper on the Canadian Plains is *Camnula pellucida* and on the Atlantic seaboard it is *Schistocerca americana.* The cotton boll worm of Texas transforms into a corn ear worm in Iowa and into the tomato fruit worm in eastern Maryland. But we are becoming agreed that the yellow fever mosquito is that self-same insect which transmits yellow fever despite the dipterist's chameleon-like changes in which he one moment decides that it is *Stegomya fasciata,* the next *Stegomya calopus,* then quickly changes to *Aedes calopus, Aedes ægypti,* or *Aedes argenteus.*

[1]Presented as part of a symposium on Present Trends in Systematic Entomology at the anual meeting of the Entomological Society of America in New York City, Dec. 27, 1928. See Psyche, vol. 36, p. 13 and 21.

Even though the day should come when scientific refinement would make the determination of our commonest insect, in a technical sense, impossible to any but the specialist, house fly will be an excellent name to indicate that troublesome aggregate of dipterous insects that may or may not spread typhoid by walking on the butter.

For a time there was a tendency to foist upon the layman a modification of the technical name, as the Calosoma beetle, brown Anomala, and apple Bucculatrix. An excellent precedent was established for this procedure by the common names applied to many plants, as Geranium, Aster, Verbena, Petunia, Alyssum and many more. But botany is a much older science than entomology and I wonder if in many cases the taxonomic botanist, or herbalist, as he was then called, did not latinize the vernacular names rather than the layman adopt the technical terms. Be that as it may, we have not been nearly so successful with insect names of this type. Then there were the "gay nineties" of geographical names, New York weevil, San Jose scale, Mexican bean beetle, and what not, until a nation's ire was raised because it was being held responsible for so many "wee tim'rous beasties."

Descriptive names are ideal, but lead us into some very ridiculous complications. We have the brown horse louse. Is it a brown louse or a louse on brown horses? And even worse, the biting horse louse. Here exidently the louse infests biting horses. So we must change it around to the horse biting louse. Now we must be careful of the accent, for it we say *horse-biting* louse we can see this louse cavorting over the pasture snapping at the horses. We must pronounce it horse *biting-louse*. And there are the black cabbage beetle, green apple aphid and countless others.

"What should be the structure of a common name?" This was a question that concerned the Association for many years. Committees profoundly considered the academic use of the hyphen, of *ed*, and of *ous*, and delved into Shakespeare and Chaucer until the codification of common names was more involved than the most intricate mental gyrations of the International Commission. But the economic entomologist has a sense of humor and when the balloon got so large that it threatened to blot out the sun, he touched it with a

cigarette and Poof! it came to earth.

A common name is a common name and that is all. It is the vernacular name, the name of the people for a thing, in this case an insect.

How simple!

We have only to find out what all the common people everywhere call an insect and after that name write what all the taxonomists agree is the correct Latin name for the same insect, and thereafter all economic entomologists, who are neither common nor taxonomic or are both, as you choose, are constrained, never to depart from this combination; unless the Common Name Committee changes its mind or some taxonomist has the temerity to disagree with his colleagues.

But seriously, it is essential that in applied entomology we have a well established vernacular name for each pest that will be associated with it in the minds of those interested in the pest from some nonacademic viewpoint.

The layman will not even try to swallow *Leptinotarsa decimlineata,* nor can we foist upon him such pseudo-academic names as irrorate leafhopper. He does not know what irrorate means, and I venture to say that there may be some in this august gathering of mental collossi who do not know what that word means.

Even more reasonable common names have failed of popular adoption. Certainly Colorado potato beetle is a nice name. It sounds nice, the insect is a beetle, it feeds on potato and it first attracted attention in Colorado, so we adopted the name. And what then? Go over most of the country and you find that the Colorado potato beetle never even occurred there. No, their pest is the potato bug.

All the Association of Economic Entomologists hopes to accomplish by the activities of its Committee on Nomenclature is a reduction of vernacular names to a reasonable minimum for any given insect and to prevent the same common name from being applied to more than one kind of insect.

To acheive the last-mentioned object is not always possible. For example, what was the apple leafhopper a few years ago is now several species of Jassidæ, but a conscien-

tious effort and serious coöperation on the part of all entomological writers can do much.

We hope to prevent the repetition of such an embarrassing situation as developed in the case of the name Japanese beetle. Long before *Popillia japonica* attracted attention in this country, American entomologists in Hawaii had named *Adoretus umbrosus* the Japanese beetle and had built up a very considerable literature around the name. Now imagine what would be our confusion if *Adoretus umbrosus* should succeed in evading the vigilance of the Port Inspectors, should enter the United States and our Common Name Committee should be confronted with the necessity for deciding on a common name for the new pest. Should it be Hawaiian Japanese beetle? A very silly name! Or should it be the Japanese beetle from Hawaii? Even worse!

Today, if entomologists will use the available facilities, it is possible to ascertain very promptly whether or not a common name has been used previously.

The Committee on Nomenclature of the American Association of Economic Entomologists maintains and attempts to keep up to date a catalogue of all of the English names that have been suggested for insects. This list now includes the common names of 4,400 species of insects, not all American but each referred to in literature under an English common name. In a duplicate reference card index, these names are arranged in one case alphabetically according to the technical names and in the other case according to the common names. Of course some insects have many common names; in fact, our index has now 5,600 common names listed.

Of this vast number the Association has adopted and published preferred names for 625 species of American insects.

One of the present trends in this branch of nomenclature and one which I believe to be fully justified is to let nature take its course in naming insect pests. This is not always possible with newly introduced pests for which names must be promptly adopted for regulatory purposes. But in other cases it is far better to wait until the people have settled upon a name for a pest than to attempt to introduce a new

name. We can not introduce a new name in most cases despite our most serious efforts. For over a century a little gray neighbor of man had borne the dignified name of body louse, then the war threw us into the trenches and zowie! We came out with cooties! It is unfortunate that the economic entomologists did not have foresight enough to introduce all of our unnamed pests into "the big parade" so that each would have come out wearing an A. E. F. name as firmly fixed for distinguished service as cootie.

GEOTRUPES HORNI BLANCHARD

This is one of the common species of the genus in this locality occurring, according to my series, from August 8 to September 30. It can be easily distinguished from the other species by its pure black color with no metallic reflections. I have found it frequently under a fungus having an acrid milky juice *(Lactarius,* perhaps *piperatus)* and it often bores from the top down through the stem and into the ground to a depth of five or six inches; I have never noticed this particular mode of attack by *G. balyi Jek.* which at times frequents the same species of fungus. I have found an adult, a pupa and a larva beneath the same fungus though it is not certain they were all *horni.* Generally but one or two specimens are taken under one plant while *balyi* may occur in from two to six specimens. *Horni* occurs in rather dense growths of oak and I took several specimens in a pine grove at South Paris, Me., on September 20, 1928. It was taken at Monmouth, Me., on September 4 and 9, 1917, under fungi. A dead specimen was picked up on the sand area back of the beach at Surfside on Nantucket Island on September 13, 1928. The range of this species is much greater than formerly recorded as I have a specimen taken by Dr. T. H. Frison at Urbana, Illinois, bearing the unusual date of April 16, (1914).

C. A. Frost.

PHENOLOGY OF OLIGOLECTIC BEES AND FAVORITE FLOWERS

By Charles Robertson

Carlinville, Illinois

Authors who have discussed this subject have made no systematic phenological observations on bees or on flowers.

Referring to the supposed short flight of oligoleges, one says: "Some claim this is so because they are small .Robertson explains it by saying that the short flight is the result of the visiting of the few closely allied genera of plants." "Both opinions are probably right." Oligolectic bees are not small and their flight averages only 11.8 days shorter than their related polyleges (4, 422). In 2, 71, it is stated that these bees are no smaller than their relatives and the percentage of small bees is no greater than among the polytropes (polyleges). Of local oligoleges, 38 per cent, while of the polyleges 37 per cent, are large. There is no need to explain something which is not a fact.

Bees with short flight.—Since the female bees do the pollen-collecting, the statements here relate to them. In 1, 30, it is shown that the females of 33 Andrenidæ, both polylectic and oligolectic, average 48 days and complete their flight in 120 days, March 17-July 14. It was argued that it was advantageous for some of these short-flying bees to fall into 11 sets with non-competitive pollen-collecting habits. Polylectic Andrenidæ average only 7.7 days longer than the oligoleges (4, 427). Oligolectic bees resemble their relatives in time even more than they resemble the plants on which they depend (3, 108). The percentages of bees flying simultaneously, May-September, are from 45.9 to 47.2 (5, 522). Short flights make it possible for the bees to be distributed so that not more than 47.2 per cent are flying at the same time (3, 107). This, I think, shows the principal advantages of a short flight.

Correlation of Oligoleges and Flowers

Of 84 oligolectic bees listed in 4, 426-7, fourteen are omitted here because their females have not been observed enough to establish their time of flight, or visits.

In the case of the other 70, the flowers which they visit for pollen average 102 days. The bees average 60 days, 20 days after the flowers begin and 22 days before the flowers end. This is not a close correlation, but the time of the bee should be well within that of the flowers. Three show the average of 42 days, 34 show less and 34 show more. The bee can hardly be expected to collect pollen until several days after it begins to fly, but it is fairly necessary that it should find the flowers in bloom. It is even more necessary that the flowers should bloom later, so that the bee can work up to its last day.

Details

Colletes oligoleges. *Colletes æstivalis,* 55 days, begins 4 days after and ends 3 days before *Heuchera hispida,* 62 days, May 4-July 4. *C. brevicornis,* 32 days, begins 9 days after and ends on the same day as *Specularia perfoliata,* 41 days, April 20- June 29. *C. willistonii,* 101 days, begins 17 days after and ends 29 days before *Physalis,* 147 days, May 11-October 4. *C. latitarsis,* 108 days, begins 36 days after and ends 3 days before *Physalis. C. armatus,* 46 days, begins 25 days after and ends 24 days before the Astereæ which it visits, 95 days, July 29-Oct. 31. *C. americanus,* 73 days, begins 27 days after its Astereæ and Heliantheæ, 100 days, July 24-Oct. 31, and ends on the same day. *C. compactus,* 48 days, begins 47 days after and ends 10 days before its Compositæ, 105 days, July 19-Oct. 31. These *Colletes* range from 32 to 108 days, and are short or long to agree with their flowers. Only two, *C. latitarsis* and *willistonii,* get pollen from the same plants.

Andrenid Oligoleges

Salix oligoleges. The willows bloom from March 17 to August 11, 148 days. The 6 oligoleges, whose flight-times are pretty well made out, fly from 46 to 88 days, average 86 days shorter than the season of *Salix.* They average 10 days

after *Salix* begins and 76 days before it ends. All of them complete their flight 46 days before *Salix* ends. *Andrena salicis*, 47 days, begins with *Salix* and ends 101 days sooner. *Parandrena andrenoides* begins 3 days later and ends 67 days sooner. *Trachandrena mariæ* shows 8 days later and 86 earlier. *Andrena illinœnsis* shows 8 and 81, *salictaria* 14 and 46, *erythrogastra* 26 and 76. Of these equally common species, 3 average 26 days shorter than the other 3, while the Andrenid oligoleges, as stated above, in general average only 7.7 days shorter than the polyleges.

Other vernal species. *Ptilandrena erigeniæ*, 50 days, begins 10 days after and ends 10 days before *Claytonia virginica*, 70 days, March 16-May 24. *P. polemonii*, 37 days, begins 2 days after and ends 4 days before *Polemonium reptans*, 43 days, April 12-May 24. *P. g. maculati*, 24 days, begins 18 days after and ends 11 days before *Geranium maculatum*, 53 days, April 13-June 4. *Pterandrena krigiana*, 35 days, begins 11 days after and ends 4 days before *Krigia amplexicaulis*, 50 days, May 1-June 19. *Trachandrena spiræana*, 13 days, begins 6 days after and ends 9 days before *Aruncus sylvester*, 28 days, May 24-June 20. *Iomelissa violæ*, 51 days, begins 13 days after and ends 20 days before *Viola*, 84 days, March 17-June 8. *Andrena arabis*, 29 days, begins 34 days after and ends 9 days before its Cruciferæ, 72 days, March 20-May 30. The Cruciferæ in general bloom 226 days, March 20-Ocober 31, far beyond the time of this bee. *Opandrena ziziæ*, 47 days, begins 15 days after and ends 30 days before the *zizioid Umbelliferæ*, 92 days, April. 18-July 18. All of these oligoleges and 26 Andrenid polyleges complete their flight in the time of *Salix*.

Late Andrenid oligoleges. *Andrena nubecula*, 79 days, begins 12 days after and ends 1 day before its Astereæ, 92 days, August 1-October 31. *Pterandrena solidaginis*, 71 days, begins 20 days after and ends 8 days before its Astereæ, 99 days, July 24-October 31. *P. asteris*, 37 days, begins 32 days after and ends 10 days before its Astereæ, 79 days, August 14-October 31. *P. aliciæ*, 69 days, begins 35 days after and ends 6 days before its Heliantheæ, 110 days, July 9-October 26. *P. rudbeckiæ*, 67 days begins 11 days after and

ends 70 days before its Heliantheæ, 148 days, June 1-October 26. *P. pulchella,* 48 days, begins 33 days after and ends 12 days before its Heliantheæ, 93 days, July 15-October 15. *P. helianthi,* 38 days, begins 41 days after and ends 21 days before its Astereæ and Heliantheæ, 100 days, July 24-October 31. None of the Pterandrenas get pollen from the same Compositæ.

Other Short-tongued Oligoleges

Macropis steironematis, 33 days, begin 12 days after and ends 36 days before *Steironema,* 81 days, June 16-July 18.

Halictoides marginatus, 34 days, begins 39 days after and ends 1 day before *Helianthus,* 74 days, July 23-October 4.

Panurgidæ. *Anthemurgus passifloræ,* 51 days, begins 16 days after and ends 17 days before *Passiflora lutea,* 84 days, July 5-September 26. *Pseudopanurgus compositarum,* 54 days, begins 43 days after and ends 2 days before its Astereæ, 99 days, July 24-October 31. *P. asteris,* 62 days, begins 35 days after and ends 8 days before its Astereæ and Heliantheæ, 105 days, July 19-October 31. *P. solidaginis,* 86 days, begins 8 days *before* and ends 13 days before its Astereæ and Heliantheæ, 91 days, July 11-October 4. But it begins 79 days after and ends 27 days before the general Astereæ and Heliantheæ, 192 days, April 23-October 31. *P. albitarsis,* 100 days, begins 4 days after and ends 21 days before its Heliantheæ, 125 days, May 25-September 26. *P. rudbeckiæ,* 43 days, begins 61 days after and ends 44 days before its Heliantheæ, 148 days, June 1-October 26. *P. rugosus,* 61 days, begins 24 days after and ends 25 days before its Heliantheæ, 110 days, July 9-October 26. *P. labrosus,* 57 days, begins 19 days after and ends 28 days before its Heliantheæ, 104 days, July 15-October 26. *P. labrosiformis,* 42 days, begins 54 days after and ends 31 days before its Heliantheæ, 127 days, June 22-October 26. *Calliopsis coloradensis,* 31 days, begins 3 days *before* and ends 18 days before its Astercæ and Heliantheæ, 46 days, August 23-October 7. *Verbenapis verbenæ,* 75 days, begins 37 days after and ends 25 days before *Verbena,* 137 days, May 22-October 5. The flight

is 62 days shorter. *Zaperdita maura,* 59 days, begins 57 after and ends 31 days before *Physalis,* 147 days, May 11-October 4. Its flight is 88 days shorter. In time and frequency it shows little relation to *Physalis. Perdita octomaculata,* 65 days, begins 6 days before and ends 11 days before its Astereæ and Heliantheæ, 70 days, August 17-October 20. None of the Compositæ oligoleges of Panurgidæ get pollen from the same flowers.

LONG-TONGUED OLIGOLEGES.

Gnathosmia georgica, 49 days, begins 19 days after and ends 25 before its Compositæ, 93 days, Apr. 23-July 24.

Ashmeadiella bucconis, 86 days, begins 11 days after and ends 31 days before its Astereæ and Heliantheæ, 128 days, May 25-Sept. 29.

Sayapis. *S. pollicaris,* 16 days, begins 22 days after and ends 14 days before *Coreopsis palmata,* 52 days, June 3-July 24. *S. pugnata,* 58 days, begins 13 days after and ends 48 days before its Compositæ, 119 days, May 25-Sept. 20. *S. sayi,* 92 days, begins one day *before* and ends 26 days before its Compositæ, 117 days, July 7-Oct. 31.

Megachile. *M. generosa,* 87 days, begins 38 days after and ends 21 days before its Papilionaceæ, 148 days, May 27-Oct. 19. *M. sexdentata,* 92 days, begins 15 days after and ends 19 days before its Astereæ and Heliantheæ, 126 days, June 1-Oct. 4.

Oligotropus campanulæ, 72 days, begins 4 days after and ends 22 days before *Campanula americana,* 98 days, July 1-Oct. 6.

Euceridæ. *Melissodes cnici,* 49 days, begins 71 days after and ends 24 days before *Cirsium,* 144 days, May 25-Oct. 15. *M. coreopsis,* 25 days, begins 11 days after and ends 16 days before *Coreopsis palmata,* 52 days, June 3-July 24. *M. vernoniæ,* 38 days, begins 34 days after and ends 21 days before *Vernonia fasciculata,* 93 days, July 1-Oct. 1. *M. vernoniana,* 62 days, begins 24 days after and ends 7 days before. *M. boltoniæ,* 120 days, begins 12 days after and

ends 21 days before its Compositæ, 153 days, June 1-Oct. 31. *M. trinodis,* 91 days, begins 19 days after and ends 25 days before its Compositæ, 135 days, June 19-Oct. 31. *M. agilis,* 98 days, begins 13 days *before* and ends 15 days after its Compositæ, 100 days, July 24-Oct. 31. *M. coloradensis,* 62 days, begins 56 days after and ends 15 days before its Compositæ, 133 days, June 10-Oct. 30. *M. simillima,* 66 days, begins 24 days after and ends 10 days before its Compositæ, 100 days, July 24-Oct. 31. *M. autumnalis,* 58 days, begins 33 days after and ends 9 days before its Compositæ, 100 days, July 24-Oct. 31. *Epimelissodes illinoensis,* 29 days, begins 27 days after and ends 34 days before its Heliantheæ, 90 days, June 19-Sept. 16. *Anthedon compta,* 76 days, begins 5 days *before* and ends 18 days before *Oenothera biennis,* 89 days, July 20-Oct. 16. Only two Euceridæ get pollen from the same flowers.

Cucurbita oligoleges. *Cucurbita pepo* blooms 94 days, July 4-Oct. 4. One of its oligoleges, *Peponapis pruinosa,* 77 days, begins 11 days after and ends 6 days before, while the other, *Xenoglossa strenua,* 62 days, begins 25 days after and ends 7 days before.

Ipomœa oligoleges. *Ipomœa* blooms 125 days, June 24-Oct. 26. One of its oligoleges, *Cemolobus ipomœæ,* 80 days, begins 9 days *before* and ends 54 days before. The other, *Melitoma taurea,* 103 days, begins 3 days after and ends 19 days before.

Cassia oligoleges. *Cassia chamæcrista* blooms 100 days, June 28-Oct. 5. One of its oligoleges, *Epimelissodes atripes,* 36 days, begins 37 days after and ends 27 days before. The other, *Amegilla walshii,* 77 days, begins 8 days after and ends 15 days before.

Emphor bombiformis, 44 days, begins 10 days after and ends 5 days before *Hibiscus lasiocarpus,* 59 days, July 20-Sept. 16.

Other Cases.

Physalis oligoleges. *Colletes willistonii,* and *C. latitarsis* fly 101 and 108 days, bearing some relation to *Physalis,* which blooms 147 days, but *Zaperdita maura* flies 59 days,

88 days shorter, with little relation to *Physalis*, though it resembles the other Panurgidæ.

Astereæ. The Astereæ bloom 192 days, Apr. 23-Oct. 31. The oligoleges average 57 days, 135 days shorter. The short flight is not on account of the absence of the Astereæ. The flowers which these bees visit for pollen average 93 days, 36 days longer than the bees.

Heliantheæ. These bloom 154 days, May 25-Oct. 26. The 9 oligoleges average 57 days, 97 days shorter. The Heliantheæ which they visit for pollen average 117 days, 60 days longer.

Other Composite oligoleges. The Compositæ bloom 192 days, Apr. 23-Oct. 31. Eighteen oligoleges average 89 days later in beginning, and 32 days earlier in ending, or 121 days shorter. The flowers they visit average 107 days.

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THELYTOKY OR ARRHENOTOKY IN *SCLERODERMUS IMMIGRANS*

By John Colburn Bridwell,

Glencarlyn, Virginia.

Parthenogenesis is a common occurence among hymenoptera. Usually it is androgenetic, only males being produced by virgin females. This phenomenon has also been termed arrhenotoky. It is so general among hymenoptera as to lead many students of the group to believe that all the species of the order may breed in this way except for the few which have developed thelytoky, virgin females producing females. Certain Eupelmidæ and Encyrtidæ among the Chalcidoidea, and some Ichneumonidæ have been bred through many generations without males appearing and have to all appearances entirely eliminated sexual reproduction as a part of ontogeny. In other instances however after long periods of gynogenetic parthenogenesis, small numbers of males appear and it is far from certain that any of the species have become perfectly thelytokous. I know of no species, however, which produce large numbers of males and also produce females parthenogenetically. The notes by Dr. Keeler, 1929 (Psyche 36:41-44) on thelytoky in *Scleroderma immigrans* are so much at variance with my experience in breeding *Sclerodermus*[1] that I am convinced an error of observation has mislead him.

The discussion of the biology of *Sclerodermus immigrans* Bridwell and its endemic Hawaiian congeners may be found in the Proceedings of the Hawaiian Entomological Society 4:291-305, 1920. In the course of the work recorded several thousand individuals of this species were reared under very close and long continued observation and among them were many known virgin females whose progeny in every instance were males. In many instances the lots of

[1]It may not be superfluous to note again that *Sclerodermus* is Latreille's original spelling of this generic name and *Scleroderma* a wholly unnecessary emendation on the part of Westwood.

young produced by old females near the end of their egglaying periods were all males, the sperms from mating having presumably been exhausted or were dead. Nothing in all this work suggested the possibility of thelytoky. The only other species of *Sclerodermus* bred in large numbers is *S. macrogaster* Ashmead which I found at Kingsville, Texas in January, 1920 and bred through several generations at Brownsville and at Washington until opportunity presented itself to put it in the hands of Dr. Wheeler for study. Since its biology differed but little from that of *immigrans* and its Hawaiian congeners, no detailed account of these studies was published. A note upon it was presented to the Entomological Society of Washington as recorded in 1922, (Journ. Washington Acad. Sci. 12:274). In this species also the phenomena of arrhenotoky were observed, probably in more instances than in *immigrans*. In it, as in *immigrans*, about one third of the females were winged while only a small fraction of one per cent of the males were wingless.

If we review the conditions under which the progeny of *Sclerodermus* are produced we may see how a misunderstanding might arise. After the prey is mastered several eggs are laid upon it and the resulting larvæ and their mother feed upon it. When the larvæ are ready for transformation they spin separate coccoons so massed and attached to each other as to make it impossible to separate them without injury. The males emerge before the females and bite their way into the female coccoons and mate there before any of them have made their appearance in the open. The males are short lived and often only one or two appears in a mass of coccoons such as would produce eight females. Dr. Keeler intended keeping eight of the females of his F 3 generation virgin and from these supposedly virgin females only female progeny were produced. Since he does not detail the precautions taken to keep them from mating, I believe that these had mated before they were separated and that the few (normally not more than one fifth) male larvæ died before transforming.

CRITICAL DATA UPON THELYTOKY IN *SCLERODERMA IMMIGRANS.*

By Clyde E. Keeler.[1]

On account of the unusual nature of my results in breeding *Scleroderma immigrans,* I thought it well to record the evidence pointing toward thelytoky in my specimens. (Psyche, Vol. XXXVI, No. 1, pp. 41-44)

Mr. Bridwell suggested (Psyche, Vol. 36, p. 120) that my F3 females might not have remained virgin, due to the fact that the early hatching males have been known to chew holes into the neighboring cocoons and fertilize their unhatched sisters. The possibility suggested is quite reasonable and makes necessary a more detailed explanation of the results summarized in Table 1 of my former paper.

In this table I did not report the contents of all the vials individually. The data given under F3 as 1 winged ♂, 1 wingless ♂, and 12 wingless ♀ ♀, consisted of insects born in five separate vials.

Vial No. 1 hatched Aug. 14, 1928. A wingless ♂, and a wingless ♀ emerged and were removed from the vial. Later in the day two wingless ♀ ♀ hatched and were kept virgin.

Vial No. 2 hatched Aug. 27. In this vial was found one wingless ♀ which was kept virgin.

Vial No. 3 hatched Aug. 29. This vial contained four wingless ♀ ♀. They were kept virgin.

Vial No. 4 hatched Sept. 16. In this vial there hatched a single wingless ♀, which was kept virgin.

Vial No. 5 hatched Sept. 16. In this vial were found 1 winged ♂ and 3 winged ♀ ♀. These were mated together.

[1]Research Fellow, Harvard Medical School.

No other insects could have hidden in the vials undetected because all coccoons in the vials were dissected with forceps at the time of examination.

The two virgin ♀ ♀ of vial No. 1 were placed in a separate vial and when the female of vial No. 2 emerged, she was placed with them.

Of the four females in vial No. 3, three were placed in a single vial and the fourth in a separate vial.

The female of vial No. 4 was also given a separate vial.

Mr. Bridwell's objection might be thought to apply to the two virgin females removed from vial No. 1, had I not examined their cocoons for holes when I removed the wingless ♂ and the wingless ♀.

But supposing Mr. Bridwell's assumption to be correct in the case of vial No. 1, and, that sperm could have been transmitted through holes in their cocoons too small to be detected with a hand lens, this would throw out only the data obtained from the virgin females of vials Nos. 1 and 2, the offspring of which (born Oct. 31) consisted of 14 wingless females.

Even then, we would be unable to account for the 19 ♀ ♀ from the virgin females born in vials Nos. 3 and 4 in which vials no males occurred.

Errata in previous paper: Table 1, column 4, line 2 (read ♂ instead of ♀ ; line 4 (read 14 instead of 4).

A NEW SPECIES OF BLEPHAROCERA FROM MASSACHUSETTS (DIPTERA)

By O. A. Johannsen,

Ithaca, N.Y.

Blepharocera similans n. sp.

♂. Head dark brown including antennæ, palpi a little paler. Face one-third as wide as head, front one-third wide as face. These measurements are based on a relaxed specimen. The area of enlarged facets about as with *B. tenuipes*. Antenna twice, the palpus as long as the width of the head. Fifteenth antennal segment a fifth longer than the fourteenth; last palpal segment slender, and three times as long as the penultimate. Thorax yellow including scutellum; the mesonotum shining brown with a purplish tinge and only faintly pollinose, the median space in front of scutellum with a pearly lustre; anterior part of pleura, brown. Abdomen brown, somewhat shining, posterior segments and hypopygium darker; venter yellow anteriorly; narrow posterior margins of the first two or three tergites paler. Structure of the hypopygium closely resembles that of *B. tenuipes*. See Kellogg's figure 2, plate 22, in the Proceedings of the California Academy of Sciences, 1903. In this figure the lateral lobes of the dorsal plate have parallel sides, their caudal margins squarely truncate, with the outer posterior angle of the lobe acute, the inner one right angled and the median tooth small. In my specimens of *B. tenuipes* the median tooth on the caudal margin of the lateral lobes of the dorsal plate is more conspicuous than that figured by Kellogg and with the apex directed slightly mesad. The lobe in the new species, *B. similans*, is relatively longer and the inner angle wholly wanting, the inner margin of the lobe gradually curving from the median tooth toward the base of the lobe. The claspers of *B. similans* are slightly more

curved than in *B. tenuipes*. Legs brown, slender, middle femur a tenth longer than the fore femur; tibiæ and comsponding tarsal segments of fore and middle legs subequal, the measurements for the middle leg beginning with the femur being 2.8, 2.4, 1.4, 0.6, 0.4, 0.25, 0.25 mm. Hind legs wanting in the type specimen. Wing clear hyaline, iridescent; length from basal articulation, 4.5 mm. Halteres yellow with brown knob. Length of fly 4 mm. Amherst, Massachusetts, June 25, 1927. Dr. C. P. Alexander, Collector.

Aside from the difference in the form of the hypopygium as noted above, this fly differs from *B. tenuipes* in having a distinctly shining thorax, in the proportion of its tibia to basitarsus being 12 to 7 instead of 12 to 6, in the sides of the face being more nearly straight and in the hairs on the base of the claws being less conspicuous.

I am indebted to Mr. F. W. Edwards for submitting this fly to me for description. Several specimens in the British Museum, type in the Cornell University collection.

XENILLUS CLYPEATOR ROBINEAU-DESVOIDY AND ITS IDENTITY

By Arthur Paul Jacot

Shantung Christian University, Tsinan, China.

In 1839 André Jean Baptiste Robineau-Desvoidy described a new genus and species of beetle under the above name, which he secured on the twelfth of July on agarics of an old cherry tree at Saint-Sauveur, Yonne (about 100 miles south of Paris), France. General Dejean, to whom the unique specimen was presented, considered it an acarid and Lucas and Démary were appointed to restudy and report on it. They considered it as related to the Oribatids or Uropodids. It was then submitted through Mr. Audouin to Antoine Louis Dugès who had made a few studies on Acarians, and who referred it to *Oribates castanæ* Hermann 1804 (type locality Strasbourg). Little did Dugès realize, nor did anyone of that time, the fact that any mesophytic locality can boast of 60-80 species. A comparison of Hermann's description of *O. castanæ* with that of *X. clypeator* brings out this point, the former being nearly spherical not ovoid, shining not granular, cephaloprothorax short, not rather long.

A carefull perusal of Robineau-Desvoidy's description reveals two important points (1) he mistakes the anterior pair of legs for antennæ (giving them 5 joints) thus giving his animal three pairs of legs, instead of four, (2) he mistakes the pseudostigmata for eyes.

The description of Lucas and Démary who were, especially Lucas, much more competant students, is far more detailed than that of the finder and is the basis for the present study. They describe the "antennæ" as broken off so short as to leave but a small, cylindric pedicel. Their description includes three outstanding clues to the generic relations of this animal: (1) no plate or wing-like outgrowths to the "carapace" (notogaster) are mentioned in

a detailed description and as this is a conspicuous feature, one may consider them as lacking; (2) the armature of the cephaloprothorax is described chiefly on pages 466-467. Most of page 467 is taken up with the description of a structure which Nicolet called a tectum or head-roof. (3) The notogaster (last line of page 468) is described as oval, vaulted (like the carapace of a turtle) with rugose, shagreened surface (Robineau-Desvoidy called it granular).

Fortunately there is but one group of apterogasterine Oribatids to which this description applies, namely, that called Cepheus by Nicolet (not Koch). A more detailed comparison of the description of Lucas and Demary, with the species figured by Nicolet and by Michæl under the names *Cepheus vulgaris, C. tegeocranus* and *C. latus* will make this identity the more certain.

In describing the cephaloprothorax these authors first describe (p. 466) the structure of the portion below the tectum. Of this they say: "Four main pieces form this head, three latero-superior and one inferior. Two of the latero-superior pieces are thin, transversely flattened, and articulate posteriorly with the first piece which forms the thorax or rather the cephalothorax; they are directed forward and approximate each other so as to circumscribe a triangular space which encloses the third medio-superior piece. [These two latero-superior pieces are thus the *genæ* of Michæl]. This latter articulates behind with the median and anterior part of that kind of shield which covers over the body [notogaster] [i. e. it is the rostrum and dorso-vertex of Michæl]. Laterally it merges with the projecting blades or ears which we have already indicated [preceding paragraph, i. e. lamellæ]; as it proceeds anteriorly they gradually narrow or turn inward, and terminate at the anterior part of the two lateral plates [genæ], but without merging intimately with them, so that one distinguishes at their ends two little grooves separating three little tubercles called the upper lip. [This condition is clearly indicated in Michæl's 1883 volume, pl. 16, fig. 9: *C. tegeocranus*, where *a* is the medio-lateral piece separated from the triangular lateral piece by a slender tectopedial ridge, also in Nicolet, pl. 7 (31), fig. 8c where the rostral bristle is shown on a

tubercular projection of the tectopedium]. They receive in their spread an inferior, horizontal piece which springs from below the first segment of the thorax, bends at its anterior part and houses itself in the midst of the three others. This single piece, larger than each of the preceding, constitutes of itself, the labium."

"Above this head one finds a solid organ which surpasses it at the sides, and gives it [the head] the appearance of being retracted beneath its lower [proximal] part; it is composed of three pieces, two lateral and a median. The median piece is convex, closely fused with the two lateral pieces, near the posterior half of its lateral edges, and ends anteriorly, as already stated between the two pieces of the upper lip [genæ]. The two lateral pieces [lamellæ] are triangular; situated on a higher plane than the median piece, they seem to continue by their exterior edges the curve form by the sides of the carapace [notogaster] [see Michæl 1883, pl. 17, figs. 1 and 12 or Nicolet pl. 7 (31), fig. 9]. Their small end directed forward is pointed, projecting, but does not extend to the extremity of the head; their base articulates with the anterior and lateral part of the dorsal piece [i. e. notogaster]; their inner edges recurve and merge, first [on the inside] with the median piece [of the tectum], then [on the outside] with the lateral pieces of the upper lip [i. e. the proximal part of the genæ or acropleuron of Michæl], forming with them an obtuse more or less rounded angle. These two lateral pieces [lamellæ] include between them and the genæ, a deep groove which encloses, at its posterior part, a small, round black eye, without facets [pseudostigmata], and, a little below this thing, that little cylindrical body which we have noted as probably being the first article of the antennæ described by Robineau-Desvoidy [i. e. coxa of leg I]."

Thus the description corresponds accurately with these so called Cepheus and as he describes the apex of the lamellæ as pointed, it would seem to be *C. vulgaris* Nicolet (=*N. tegecranus* Hermann). The generic identity is further corroborated by the description of the legs which Michæl has figured on plate 17. Lucas and Démary say: "We have

been struck by the largeness and length of the coxa [hanche] of the third [i. e. fourth] pair of legs; this last dimension equals at least half that of the femur [cuisse] [fig. 10]. This is so much the more remarkable, as in the other pairs of legs the coxa is barely perceptible and the femur is slender [figs. 8 and 9]. The tibias do not diminish in size at the femoral end, but are more slender at the middle." This is particularly interesting and unusual. The remainder of the paragraph is inaccurate and irrelevant.

Finally, it is significant that without stretching the description to fit the species *X. clypeator* should be the commonest species of this genus occuring in central Europe. Although this species (like the elephant and the tea-pot) is not known to climb trees, is is not certain that the agarics were on standing trees, while it is reported by Michæl to burrow in moss and old wood.

Until, therefore, *Xenillus clypeator* can be proved to ressemble more some other species, point for point, than it does *Cepheus tegeocranus* of early authors, in structure and habits, it will have to be considered monotype of the genus Xenillus and synonym of *N. tegeocranus* Hermann 1804 or: *Xenillus tegeocranus* (Hermann).

DIPTERA OF LABRADOR

By Charles W. Johnson

Boston Society of Natural History

This list was for the most part prepared some time ago, but was laid aside to await the determination of few species. In the meantime, however, other work intervened. The list represents the results of a number of expeditions by zoölogists and collectors including Alpheus S. Packard in 1860 and 1864. Samuel Henshaw in 1881, Lucien M. Turner in 1882 and 1883, J. D. Sornborger in 1892 and 1897, A Stecker and J. D. Sornborger in 1899, Dr. C. W. Townsend and G. M. Allen 1906, Owen Bryant 1908 and O. L. Austin, Jr., 1927. There is also added to the list a number of species more recently described by C. P. Alexander, J. R. Malloch, C. H. Curran, and A. L. Melander, the names of the collectors being given in connection with the species described. The following list contains about 170 species.

Trichoceridæ

Trichocera Meigen

T. sp. Nain, Aug. 18, Kangalasiornik, Sept. 15 (Bryant).

Tipulidæ

Dicranomyia Stephen

D. halterata O.S. Battle Harbor, July 11.

Dactylolabis Osten Sacken

D. rhicnoptiloides Alex.

Limnophila (*Dactylolabis*) *rhicnoptiloides* Alex. Rept. Can. Arctic Exped. 1913-18, Crane-flies, p. 6 c. 1919.

The type was taken at Bernard Harbor, N. W. Ter-

ritories. It was later recorded from Ellesmereland by Dr. Alexander, collected on the Second "Fram" Expedition.

A specimen of this species was taken at Joksut, an inlet just south of Cape Chidley, Aug. 17, 1927, by O. L. Austin, Jr. Specimen in the Museum of Comparative Zoölogy.

Chionea Dalman

C. waughi Curran. Can. Ent. vol. .57, p. 24, 1925. Cabot Lake, Sept-Oct. and Voisey's Bay, Dec. 5, 1921 (F. W. Waugh).

Limnophila Macquart

L. subunica Alex. Rama, 1899 (Stecker).

Tricyphona Zetterstedt

T. hyperborea O. S. "Labrador." (Osten Sacken).

T. inconstans O. S. Cape Charles, July 28 (Allen).

Dolichopeza Curtis

D. americana Needh. Rigolet, July 16 (Allen).

Prionocera Loew

P. electa Alex. Can. Ent., vol. 59, p. 188, 1927. Hopedale, July 1, 1923 (W. W. Perrett).

Tipula Linnæus

T. angustipennis Loew. Hopedale and Caribou Isl. (Packard). Rama (Sornborger).

T. aperta Alex. Can. Ent., vol. 40, p. 62, 1918. (*T. imperfecta* Alex. 1915 *non* Brunetti. 1913). "Labrador" (Packard).

T. canadensis Loew, Hopedale, July 31, 1922, June 21, 1924. (W. W. Perrett).

T. entomophthoræ Alex. Can. Ent., vol. 60, p. 99, 1928 Hopedale, June 19-27, 1925 (W. W. Perrett).

T. grenfelli Alex. Can. Ent., vol. 60, p. 96, 1928. Hopedale, July 7, 1923 (W. W. Perrett).

T. labradorica Alex. Insec. Inscit., vol. 3, p. 128, 1915. (*T. tessellata* Loew 1863 *non T. tessellata* de Villers 1789 Battle Harbor July 11, Great Caribou Isl., July 14 (Allen).

T. macrolabis Loew. Rama, Aug. 24, 1882 (Sornborger Hopedale, June 19-Aug. 4, (W. W. Perrett).

T. nebulipennis Alex. Battle Harbor, Aug. 1, 1912 (G. P. Engelhart).

T. packardi Alex. Can. Ent., vol. 60, p. 99, 1928. Hopedale, Aug. 24, 1924 (W. W. Perrett).

T. perretti Alex. Can. Ent., vol. 60, p. 98, 1928. Hopedale, July 17, 1923. (W. W. Perrett).

T. productella Alex. Can. Ent., vol. 60, p. 100, 1928. Hopedale, Sept. 13, 1923 (W.W. Perrett).

T. septentrionalis Loew. "Labrador" (Schneider) Hopedale, June 18-July 5 (W.W. Perrett).

T. serta Loew (*T. albonotata* Doane). Hopedale, June 19 to Aug. 4 (S.S. Perrett).

T. subserta Alex. Can. Ent. vol. 60, p. 97, 1928. Hopedale (Packard). Rama 1894 (Sornborger). Hopedale July 18-25 (W.W. Perrett).

Culicidæ

Aedes Meigen

A. punctor (Kirby). *A. provocans* Walk. St. Lewis Inlet, Rigolet and Cape Charles July 12 to 28 (Allen).

Chironomidæ

Culicoides Latreille

C. sp. "Labrador" (Packard).

Tanypus Meigen

T. monilis Linn. Great Caribou Isl., July 26 (Allen).

T. sp. Hopedale (Packard).

Chironomus Meigen

C. annularis De G. Hopedale (Packard), Great Caribou Isl., July 27 (Allen).

C. cristatus Fab. Hopedale (Packard), Great Caribou Isl., July 27 (Allen).

C. riparius Meig. Hopedale (Packard).

C. brunneipes Zett.? Hopedale (Packard) Cape Charles, July July 29 (Allen).

CECIDOMYIIDÆ

Rhabdophaga Westwood

R. sp. Hopedale, (Packard).

Packard in his Labrador Coast, p. 390, records *Micromyia leucorum* with the following note: "Prof. C. W. Woodworth writes me that on examining the collection of Diptera which I made in Labrador, and which is now in the Cambridge Museum, he detected the rare European Cecidomyid, *Micromyia leucorum*, belonging to a genus hitherto unrecorded for North America."

I have examined the specimen referred to and thus labeled in the Museum of Comparative Zoölogy, and find that it is a Chironomid.

MYCETOPHILIDÆ

Gnoriste Meigen

G. megarrhina Osten Sacken, Nain, Aug. 18, (Bryant).

Mycomya Rondani

M. maxima Johannsen, Nain Aug. 18 (Bryant). The type locality "Maine," should read Nain.

Allocadia Winnertz

A. sp. Nain Aug. 18 (Bryant).

Neosciara Petty

N. sp. St. Lewis Inlet, July 12 (Allen).

Bibionidæ

Bibio Geoffroy

B. inæqualis Loew ♂ ♀ Hopedale (Packard). Rama 1899, (Stecker and Sornborger). Cape Charles July 29 and 30 (Allen).

Bibio bryanti sp. nov.

♂ Head, antennæ and palpi black, pile of the eyes long and brown. Thorax black, shining with long black pile. Abdomen black, whitish pile. Legs reddish, with yellowish hairs, coxæ and knees black, the inner spur of the front tibiæ about one-half the length of the outer one, the posterior tibiæ and metatarsi enlarged, the latter about as long as the second and third joint combined. Wings hyaline, the costa, stigma and first and second veins brown. Halteres dark brown. Length 8 mm. Nain, Aug. 18 (Bryant). Rama, Aug. 24 (Sornborger). Holotype and paratypes in the Museum of Comparative Zoölogy.

It resembles *B. variabilis* Loew, but the lighter colored femora and enlarged metatarsi readily separates it. From *B. fumipennis* Walk, it is distinguished by its light colored wings and veins and the noticeably thicker tibiæ and metatarsi.

Bibio labradorensis sp. nov.

♂ Head, antennæ and palpi black, the pile on the eyes brown. Thorax black, shining, pile yellowish. Abdomen black pile yellow. Femora black, tibiæ and tarsi yellow, the latter very short, the posterior tibiæ as large as the femora and posterior metatarsi about one-half the diameter of the tibia, the second joint of the tarsus also noticeably enlarged. Wings hyaline, the anterior veins and stigma light yellow. Halteres dark brown. Length 5.5 mm. Two specimens. Nain, Aug. 18, 1908 (Bryant).

This species resembles a small *B. variabilis* Loew, but differs in having thickened metatarsi and obsolete stigma. Holotype and paratype in the Musem of Comparative Zoölogy.

SCATOPIDÆ

Aspistes Meigen

A. analis Kirby. Hopedale (Parkard).

SIMULIIDÆ

Simulium Latreille

S. venustum Say. Cape Charles, July 29 (Allen).

S. (Wilhelmia) vittatum Zett. Fort Chimo (Turner). Hawk's Harbor, July 20, '08. (Peary's North Pole Expd.)

Prosimulium Roubaud

P. hirtipes Fries. Rigolet and Cape Charles, July 18 and 28 (Allen). Nain, Aug. 18 (Bryant). Hawk's Harbor, July 20, '08 (Peary's North Pole Expd.)

STRATIOMYIDÆ

Beris Latreille

B. annulifera var. **brunnipes** Johns. Psyche, vol. 33, P. 109, 1926. Parroquet Isl., July 21, 1881 (Henshaw). Strait of Belle Isle (Packard.)

TABANIDÆ

Chrysops Meigen

C. excitans Walk. St. Lewis Inlet, July 12 (Allen).

C. mitis O.S. St. Lewis Inlet, Great Caribou Isl. and Cape Charles, July 12 to Aug. 29 (Allen).

C. sordida O.S. Great Caribou Isl. July 29 (Allen).

Tabanus Linnæus

T. affinis Kirby, Great Caribou Isl., 27 (Allen).

T. astutus O.S. Great Caribou Isl. and Cape Charles, July 27-30 (Allen).

T. flavipes Wied. St. Lewis Inlet and Cape Charles, July 12 and 21. (Allen) Kangalasiornik Bay, Sept. 5 (Bryant).

T. illotus O.S., St. Lewis Inlet, July 12 (Allen).

T. septentrionalis Loew. Great Caribou Isl. and Cape Charles July 27-30 (Allen). Nain Aug. 18 (Bryant).

T. zonalis Kirby. Lewis Inlet, and Cape Charles, July 12 and 28 (Allen).

T. labradorensis Enderlein. (*Tyloslypia labradorensis* Ender. mitt. Zoöl. Mus. Berlin, xi, 363, 1925). "Labrador." (Enderlein).

T. cristatus Curran. Can. Ent., vol. 59, p. 81, 1927. "Labrador" (Curran).

RHAGIONIDÆ

Symphoromyia Frauenfeld

S. montana Aldr. Ungava Bay (Turner).

ASILIDÆ

Asilus Linnæus

A. nitidifacies Hine. Hopedale, Aug. 19, 1923 (W. W. Perrett).

DOLICHOPODIDÆ

Dolichopus Latreille

D. annulipes Zett. (*D. stenhammeri* Zett). Sloop Harbor, July 19, Hopedale and Caribou Isl. (Packard). Nain, Aug. 18 (Bryant). Dr. Aldrich agrees with Becker that *annulipes* is not preoccupied, c.f. Proc. U.S. Nat. Mus., vol. 61, art. 25, p. 2, 1922.

D. boreus Van D., Cole and Aldr. Ungava Bay, July 22-28 (Turner).

D. brevipennis Meig. Nain Aug. 18 (Bryant).

D. bryanti Van D., Cole and Aldr. Hopedale and Strawberry Harbor (Packard). Ungava Bay, July 29 (Turner) Great Caribou Isl. July 27 and Nain, Aug. 18 (Bryant).

D. dasypodus Coq. Hopedale and Caribou Isl. (Packard). Nain, Aug. 18 (Bryant).

D. delicatus Aldr. Ungava Bay and Fort Chimo (Turner).

D. groenlandica Zett. Ungava Bay, July 29 (Turner). Nain, Aug. 18 (Bryant).

D. packardi Van D., Cole and Aldr. Nain, Aug. 18 (Bryant).

D. latronis Van D., Cole and Aldr. Hopedale (Packard).

Hydrophorus Fallen

H. chrysologus Walk. Strait of Belle Isle (Packard).

Scellus Loew

S. filifer Loew. Nain, Aug. 18 (Bryant).

The nine specimens, all females, are a little smaller than specimens from Farwell Creek, South Saskatchewan (Mrs. Armstrong), and High River, Alberta (Owen Bryant).

Rhaphium Meigen

R. sp. Hopedale (Packard), Caribou Isl. (Packard). "Both specimens are females that I cannot determine." (M. C. Van Duzee).

EMPIDIDÆ

Bicellaria Macquart

B. uvens Mel. (Genera Ins., 74 1927) Fort Chimo, Ungava Bay (Turner).

Iteaphila Zetterstedt

I. curva Curr. Can. Ent., vol. 57, p. 24, 1925. Nain, June 15-22 (F. W. Waugh).

Hilara Meigen

H. unicolor Loew. Caribou Isl. (Packard) Nain, Aug. 18 (Bryant).

Empis Linnæus

E. lævigata Loew. Battle Harbor, July 11; Cape Charles, July 28 (Allen). Caribou Isl., Indian Harbor and Strawberry Harbor (Packard).

E. obesa Loew Nain, Aug. 18 (Bryant).

Rhamphomyia Meigen

R. incompleta Loew. Nain, Aug. 18 (Bryant).

R. setosa Coq. Great Caribou Isl., July 27 (Allen). Nain, Aug. 18 (Bryant). Strawberry Harbor (Packard).

Clinocera Meigen

C. (Hydrodromia) longifurca Mel. (Genera Ins., 231, 1927) Nain, Aug. 18 (Bryant).

C. (Hydrodromia) conjunta Loew. Great Caribou Isl., July 27 (Allen). Nain, Aug. 18 (Bryant).

Chelifera Macquart

C. (Metachela) albipes Walk. Fort Chimo, Aug. 11 (Turner).

Tachypeza Meigen

T. winthemi Zett. Great Caribou Isl., Aug. 11.

Platypalpus Macquart

P. arcticus Mel. (Genera Ins., 344, 1927). Fort Chimo, Ungava Bay (Turner).

P. melanogaster Mel. (Genera Ins., 323, 1927). Ungava Bay (Turner).

P. prorsus Mel. (Genera Ins., 328 1928). Ungava Bay (Turner).

P. satyriacus Mel. (Genera Ins., 327, 1927) Ungava Bay, (Turner).

P. xanthopus Mel. (*P. gilvipes* Coq. not Meig.) Genera Ins., 367, 1927. Great Caribou Isl., July 14 and 27 (Allen).

PHORIDÆ

Megaselida Rondani

M. rufipes Meig. Nain, Aug. 18 (Bryant).

SYRPHIDÆ

Pyrophæna Schiner

P. granditarsus Forster "Labrador" (Henshaw).

Platychirus St. Fargeau and Serville.

P. albimanus Fabr. Great Caribou Isl., July 21 (Allen). Nain, Aug. 18 (Bryant).

P. hyperboreus Stæg. Strawberry Harbor (Packard). Nain, Aug. 18 (Bryant).

P. peltatus Meig. dark var. Two females, Nain, Aug. 18 (Bryant).

P. quadratus Say. Strait of Belle Isle (Packard).

Melanostoma Schiner

M. mellinum Linn. Strawberry Harbor (Packard).

M. obscurum Say. Strawberry Harbor (Packard).

Syrphus Fabricius

S. pallifrons Curran Kansas Univ. Sci. Bull., vol. 15, p. 172, 1924. Nain, Aug. 18 (Bryant).

S. perplexus Osburn. Kangalasiornik Bay, Sept. 5, (Bryant.

Epistrophe Walker

E. contumax O. S. Indian Harbor (Packard). Rama (Stecker and Sornborger). Great Caribou Isl., July 14 (Allen).

E. diversipes Macq. Indian Harbor, Strawberry Harbor and Caribou Isl. (Packard).

E. geniculatus Macq. Nain, Aug. 18 (Bryant).

E. insoletus Osburn St. Lewis Inlet, July 12 (Allen).

Sphæropheria St. Fargeau et Serville

S. strigata Stæger. Strawberry Harbor (Packard). Great Caribou Isl, July 14 (Allen). Nain Aug. 18 (Bryant).

Volucella Geoffroy

V. bombylans arctica Johnson.

V. facialis form *arctica* Johnson Psyche, vol. 23, p. 163, 1916.

V. bombylans arctica Johnson. Psyche, vol. 32, p. 116, 1925.

Rama, 1899 (Stecker and Sornborger), Nain (Sornborger), Nain, Aug. 18, 1908 (Bryant).

This circumpolar group of Volucella that live in the nests of various species of Bombus, form an interesting but difficult group to classify. Recognizing but one species with numerous subspecies seems to be the most satisfactory method of treating them.

Eristalis Latreille

E. arbustorum Linn. Nain, Aug. 18 (Bryant) Battle Harbor (Englehardt).

E. bastardii Macq. "Labrador" (Williston).

Helophilus Meigen

H. borealis Stæger. Rama (Stecker and Sornborger), Nain, Aug. 18 (Bryant).

H. groenlandicus O. Fab. Indian Harbor (Packard), Nain, Aug. 18 (Bryant).

H. latifrons Loew. Nain, Aug. 18 (Bryant).

OESTRIDÆ

Cephenomyia trompe Linn?

The species that infests the Barren-ground Caribou *(Rangifer articus)* is probably the same that frequents the reindeer and is circumboreal in distribution. The adult fly has not been taken. Dr. Grenfell informs me that in all the heads of the caribou that he has examined he found parasitic larvæ usually just below the ethmoid. See Insects of Labrador, in appendix to "Labrador the Country and the People" by Wilfred T. Grenfell, 1909.

Oedemagena tarandi Linn?

This is also probably the same species that infests the reindeer. The larvæ are subcutaneous, forming large lumps on the back, from which they escape when full grown through holes in the skin. Dr. Grenfell says that he has seen a skin so perforated that it was practically impossible to cut from it a pair of moccasins. The fly has not been taken in Labrador.

TACHINIDÆ

Linnæmyia R.-Desvoidy

L. varia Curran. Hopedale, June 12-July 18 (Rev. Perrett).

Fabriciella Bezzi

F. orientalis Town. (? *Tachina florum* Walk.) Cape Charles, July 3 (Allen).

F. montana Town. Nain (Sornborger).

SARCOPHAGIDÆ

Pachyophthalmus Brauer and Bergenstamm

P. distortus Allen (Proc. U.S. Nat. Mus., vol. 68, art. 9, p. 15, 1926). Hamilton Riv., Muskrat Falls, July 12-19, 1919 (S. E. Arthur).

CALLIPHORIDÆ

Protophormia Townsend

P. terrænovæ R.-Desv. "Labrador" (Sornborger).

Cynomyia R.-Desvoidy

C. mortuorum Linn. Nain, Aug. 18 (Bryant).

C. cadaverina R.-Desv. Square, Isl. (Packard). Rama and Hebron (Sornborger). Kangalasiornik Bay, Aug. 28 (Bryant).

Steringomyia Pokorny

S. flavipalpis Macq. Indian Harbor (Packard).

Boreellus Aldrich and Shannon

B. atriceps (Zetterstedt).

Sarcophaga atriceps Zett. Dipt. Scand., vol. 4, 1311, 31 1843.
Melinda atriceps Hend. Wien. Ent. Zeitz., xx 33, 1901.
Onesia atriceps Zett. Katal. Pal. Dipt., III, 550, 1907
Phormia cærulea Mall., Rept. Can. Arctic Expd., vol. 3, pt. c, p. 61 c, 1919.
Boreellus aristatus Aldr. & Shan., Insec. Inscit., xi, 107, 1923.
Boreellus atriceps Shan., Proc. Ent. Soc. Wash., vol. 28, p. 128, 1926.
Mallochomyia johanseni Town. Insec. Inscit., Vol. 14, p. 25, 1926. Gready Harbor, Aug. 8 (Bryant).

Calliphora R.-Desvoidy

C. vomitoria Linn. Indian Harbor (Packard).

MUSCIDÆ

Musca Linnæus

M. domestica Linn. near Killinek, Sept. 5 (Bryant).

Myospila Rondani

M. meditabunda Fab. Great Caribou Isl., July 27 (Allen).

ANTHOMYIIDÆ

Phaonia R.-Desvoidy

P. errans Meig. Square Isl., July (Packard).

P. monticola Mall. Rama and Indian Harbor (Packard). Nain, Aug. 18 (Bryant).

P. serva Meig. Strait of Belle Isle. (Packard). Rigolet, July 5 (Allen).

Trichopticus Rondani

T. innocuus Zett. Strawberry Harbor (Packard). Great Caribou Isl., July 27 (Allen). Nain, Aug. 18 (Bryant).

T. septentrionalis Stein., Nain. Aug. 18 (Bryant).

T. spiniger Stein. Nain, Aug. 18 (Bryant). Caribou Isl. Packard).

Rhynchotrichops Schnabl

R. subrostrata Zett. .Battle Harbor, July 11 (Packard). Great Caribou Isl., July 14 (Allen).

Pogonomyia Rondani

P. quadrisetosa Mall. Can. Arctic. Expd., vol. 3, pt. c. p. 66c, 1919. Nain.

Helina R.-Desvoidy

H. fulvisquama Zett. *(H. tuberculata* Mall., Can., Ent., Vol. 51, p. 277, 1919, not Mall., Trans. Amer. Ent. Soc., vol. 46, p. 138, 1920). Rigolet, July 18 (Allen).

H. duplicata Meig. Caribou Isl. (Packard).

Spilaria Schnabl.

S. lucorum Fall. Nain, Aug. 18 (Bryant).

S. marmorata Zett. Caribou Isl. and Straits of Belle Isle (Packard).

Hydrotæa R.-Desvoidy

H. cristata Mall. Indian Harbor (Packard).

Fannia R. Desvoidy

F. scalaris Fab. Caribou Isl. (Packard).

Spilogona Schnabl and Dziedzicki

S. alticola (Mall.) Trans. Amer. Ent. Soc., vol. 46, p. 153, 1920. Nain, Aug. 18 (Bryant).

S. sp. Nain, Cape Charles and Caribou Isl.

Lispocephala Pokorny

L. erythrocera Desv. Caribou Isl. and Strawberry Harbor (Packard).

Cœnosia Meigen

C. humilis Meig. Cape Charles, July 29 (Allen). Caribou Isl. (Packard).

Prosalpia Pokorny

P. angustitarsis Mall. Nain, Aug. 18 (Bryant).

P. silvestris Fab. Straits of Belle Isl., Indian Harbor (Packard).

Hylemyia R. Desvoidy

H. brassicæ Bouche. Nain, Aug. 18. Killinek, Sept. 5 (Bryant).

H. cilicrura Rond. Caribou Isl. (Packard).

H. antiqua Meig. Hopedale (Packard).

Egle R.-Desvoidy

E. mystacea Coq. "Labrador (Malloch). Nain, Aug. 18 (Bryant).

E. muscaria Meig. Strawberry Harbor and Hopedale (Packard).

Paregle Schnabl and Dziedzicki

P. radicum Linn. Nain, Aug. 18 (Bryant).

Pegomyia R.-Desvoidy

P. fuscofasciata Mall. Nain, Aug. 18, (Bryant). Caribou Isl. and Strawberry Harbor (Packard).

P. labradorensis Mall. (Trans. Amer. Ent. Soc., vol. 46, p. 176, 1920 Nain, Aug. 18. Kangolasiornik, Sept. (Bryant). Indian Harbor (Packard).

Fucellia R.-Desvoidy

F. maritima Haliday, Great Caribou Isl. July 14 (Allen). Caribou Isl. (Packard).

SCATOPHAGIDÆ

Scatophaga Meigen

S. stercoraria Linn. Indian Harbor and Caribou Isl. (Packard). Ragged Isl. July 23.

S. islandica Becker. Hopedale, Indian Harbor, Caribou Isl. and Strawberry Harbor (Packard). Hebron, Aug. 28. Rama, Aug. 24, 1897 (Sornborger). Great Caribou Isl., July 14, Gready Harbor Aug. 8, Nain, Aug. 18 (Bryant).

S. furcata Say. Ungava Bay (Turner). Nain, Rama, Hopedale and Indian Harbor (Packard). Great Caribou Isl. (Allen). Gready Harbor, Aug. 8 (Bryant).

S. estotilandia Rondani

Scatina estotilandia Rond. Archiv. Canestrini, III, fasc. I, p. 35, 1863. Archiv. Zoöl. Modena, Vol. 3, 35, 1863. Labrador. Osten Sacken, Catl. Dipt. N. Amer., 1878, p. 174, says: "Mr. Rondani in the same place mentions *Scatophaga diadema* Wied. (Montevideo) as having been received from Labrador." Hendel (Wien. Ent. Zeit., vol. 29, p. 116, 1910) in a footnote under *Thyreophorella diadema* (*Scatophaga diadema* Wied.) says:— "The insect that Rondani determined as *Scatina diadema* Wied., is doubtless a *Scopeuma* [*Scatophaga*] but not likely to be the above species." [*S. diadema*].

Trichopalpus Rondani

T. sp. Caribou Isl. (Packard); Nain, Aug. 18 (Bryant).

Pogonota Zetterstedt

P. kincaidii Coq. Nain Aug. 18 (Bryant).

Microprosopa Becker

M. hæmorrhoidalis Meig. Nain, Aug. 18 (Bryant).

Eugenacephala Johnson

E. ruficeps Curran (1925). Natashquan June-July, 1921. (F. W. Waugh).

Acanthocnema Becker

A. albibarba Loew. Nain, Aug. 18, Bryant. The type from the White Mts., N. H., is teneral.

HELOMYZIDÆ

Suillia R.-Desvoidy

S. zetterstedtii Loew. Ungava Bay (Turner).

Allophyla Loew

A. lævis Loew Caribou Isl. (Packard).

Oecothea Haliday

O. fenestralis Fall. Indian Harbor (Packard).

Scoliocentra Loew

S. fraterna Loew. Ungava Bay (Turner).

Neoleria Malloch

N. ruficauda Zett. (*Leria crassipes* Loew) Ungava Bay (Turner). Gready Harbor, Aug. 8. Nain, Aug. 18 (Bryant).

BORBORIDÆ

Borborus Meigen

B. arcticus Mall. Fort Chimo, Ungava Bay (Turner).

SCIOMYZIDÆ

Dictya Meigen

D. umbrarum Linn. Great Caribou Isl., July 29 (Allen).

SAPROMYZIDÆ.

Minettia R. Desvoidy

M. lupulina Fab. Strawberry Harbor, Hopedale (Packard).

PALLOPTERIDÆ

Palloptera Fallen

P. jucunda Loew. Parroquet Isl., July 27, 1881 (S. Henshaw).

PIOPHILIDÆ

Piophila Fallen

P. casei Linn. Indian Harbor and Hopedale (Packard).

EPHYDRIDÆ

Scatella R.-Desvoidy

S. stagnalis Fall. Nain, Aug. 18 (Bryant). Hopedale, Strawberry Harbor (Packard).

CHLOROPIDÆ

Chlorops Meigen

C. melanocera Loew, Nain, Aug. 18. Kangalasiornik Bay, Sept. 5, (Bryant).

A BEAUTIFUL CRANE-FLY FROM SIAM

By T. D. A. Cockerell

I have lately received from Dr. and Mrs. James W. McKean along with many other insects, an extremely handsome *Tipula* collected at Chiengmai, Siam, June 28, 1928. The insect was so remarkable that I looked it up in the literature, and decided that it was allied to *T. pedata* Wied., but new.

Tipula (Tipulodina) mckeani n. sp.

♀. Length 28 mm., wing 18 mm.; hind tibia 20.2, hind tarsus 21.5, hind femur 19, ovipositor 1, antennæ about 3, proboscis 1.5 mm.

Antennal scape white at base, more than apical half brown; flagellar joints brown, with somewhat swollen black base, which carries rather long hairs. Facial and frontal regions whitish, with a dusky stripe in middle of front; sides of snout ochreous, posterior part of head dark brown. Thorax dorsally pale brownish grey, a narrow dark brown stripe anteriorly, and the lateral areas broadly pallid, the pleural region whitish; halteres light brown. Wings clear hyaline, marked with dark brown in the manner of *T. pedata* Wied, except that there is no clear costoapical spot, though the color in this region is paler, and the cell R5 is clear except at extreme base; there is a small suffused brown spot on the lower margin of cell M, just about the middle. Abdomen dark brown above, beneath pale and flavescent, segments more or less pallid along apical margins. Femora broad, with blackened apex, the anterior pair broadly dull luteous subapically. Anterior and middle tibiæ black, with a portion 4.5 mm. long and about 3 mm. from apex, creamy white; their tarsi with about the basal 7 mm. black and the rest creamy white; hind tibiæ with an additional white ring,

about 3.5 mm. long, near the base, and only about 5 mm. of their tarsi black.

Type in the collection of Dr. C. P. Alexander who confirms the species as new, and cites the following as the closest allied: *T. pedata* Wied., *T. fuscitarsis* Edw., *T. tinctipes* Edw., *T. micrantha* Alex., *T. scimitar* Alex., *T. venusta* Walk. From all of these it differs in the combination of leg pattern and coloration of body and wings.

BOOK NOTICES

A Handbook of the Dragonflies of North America. By J. G. Needham and H. B. Heywood. vi + 368 pp., with many figures and diagrams. Charles Thomas, Springfield, Illinois. $7.00.

The scattered literature relating to North American Odonata has been gathered together, digested and presented with a large amount of new material in the present book. The introduction of about fifty pages includes a short account of structure and habits and the remainder is a very complete taxonomic treatment, including keys, of the adults and nymphs so far as the latter are known. This is a "handbook" in the full sense of the word, and with its list of literature should serve as a complete guide to the field with which it deals.

C. T. Brues.

The Problems of Applied Entomology. By R. A. Wardle. vii + 587 pp., 31 figures. McGraw-Hill Book Co., New York. $6.00.

After the extensive series of text books on insects that have been published during the past few decades, it would seem that no actually new and unique treatment of any extensive entomological field could be expected. Professor Wardle has shown that such is not the case, and has worked

into a consistent treatment a vast amount of general and specific material relating to practically every phase of applied entomology without following any of the usual methods of procedure. The first ten chapters relate to general problems and deal with such diverse topics as "climatic resistance" "tropic behavior" and "stomach poisons". These serve to show the present extent of the fields invaded by the economic entomologist and the methods which he applies in his work. The more specific portion, entitled "Area Problems" deals with the problems that confront the entomologist in particular parts of the world and includes a discussion of the multitude of insects that have forced themselves upon the attention of agriculturists, foresters and medical men in all countries. A discussion of this sort has never before been attempted on so broad a scale. A very extensive and well arranged bibliography completes the book.

Professional entomologists will find this book extremely valuable and for all others interested in the problems with which it deals, it will be a useful compendium.

C. T. Brues.

NEW FORMS OF *ODONTOPONERA TRANSVERSA*

By Wm. S. Creighton

Odontoponera was first recognized as a distinct genus in 1862 when Mayr raised to generic rank an ant described a year earlier by Frederick Smith as *Ponera denticulata*. This insect was later found to be identical with Smith's *Ponera transversa* described in 1857. The name *denticulata* was, therefore, replaced by *transversa*. Although the single species by which this genus is represented is fairly abundant and distributed throughout many of the islands of the East Indies and the adjacent portions of the continent, little attention has been paid to its variations. Wheeler and Chapman in 1925 described *biconcentrica*, a variety from the Philippines but except for this no other form has been noted. Dr. W. M. Wheeler has kindly permitted me to examine the *Odontoponera* material in his collection and I find that it is possible to recognize two additional variants. One of these is plainly of subspecific rank while the other appears to be a color variety of the typical *transversa*. *Biconcentrica* must, I believe, be raised from varietal to subspecific status.

The shape and the sculpture of the node of the petiole which appear at first sight to offer striking characters for separation are quite valueless in this regard. In a series of workers from a single nest the petiole may be narrow with a deeply notched summit and heavy rugæ on the basal half or relatively broad with the notch and rugæ reduced or absent. The same is true to a lesser degree of the sculpture of the pronotum. This usually consists of more or less parallel, heavy, transverse rugæ. Occasionally, however, one or two workers in a series have the posterior pronotal rugæ twisted into two whorl-like configurations. As may be recalled this characteristic formed the basis for the recognition

[1]Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University, No. 315.

of *biconcentrica*. Were this the only distinction the validity of *biconcentrica* would be extremely doubtful but, as I shall show later, there are other very significant differences by which that form may be separated.

Smith, with his customary predilection for minor details, has noted certain characteristics of color in his original description which permit a rather accurate inference as to the nature of the true *transversa*. I have chosen to regard as typical a form which occurs in southern China, Indochina, Burma, the Phillipines, Borneo and Java. This insect shows the piceous body and ferrugineous appendages mentioned by Smith. Furthermore its distribution is considerably more extensive than that of any of the other forms and it seems logical to suppose that it would be the first to be taken. The distribution of the remaining variants is much more restricted. The range of *nitens* (subsp. nov.) extends from Borneo through Java and Sumatra to Singapore. *Infuscata* (var. nov) is known only from Java and one of the Sunda Islands. The distribution of *biconcentrica* appears to be more northern. It occurs in China and the Philippines but the material is so scarce that its range is largely a matter of speculation.

The following key may facilitate the separation of the various forms:

1. Posterior angles of the enipotum each armed with one or two acute short teeth, the subpetiolar lamella feebly pilose, the rugæ strongly shining ..... subsp. *nitens*

   Posterior angles of the epinotum each armed with a divergent series of three or four broad, coarse teeth, the subpetiolar lamella strongly pilose, the rugæ opaque or subopaque ..... 2.

2. Head one-fifth longer than broad, the sides approximately parallel; color dull yellow, the abdomen brownish ..... subsp. *biconcentrica*

   Head as broad as long, the sides feebly convex, color black, the appendages ferrugineous or brownish black ..... 3.

3. Mandibles, clypeus and appendages ferrugineous ..... *transversa*

Mandibles, clypeus and appendages blackish brown ..... var. *infuscata*

Odontoponera transversa (Fred. Smith)

O. transversa, (F. Smith), Jour. Proc. Linn. Soc. Lond. Zool. Vol. 2, p. 68 (1857) worker (*Ponera*).

Ponera transversa, F. Smith, Cat. Hym. Brit. Mus. Vol. 6, p. 86, (1858) worker.

O. transversa, Dalla Torre, Cat. Hym. Vol. 7, p. 30 (1893; Forel, Jour. Bombay Nat. Soc. Vol. 13, p. 314, Hist. (1900) worker; Bingham, Fuana Brit. India, Hym. Vol. 2, p. 73, f. 38, (1903) worker ♀.

Emery, Gen. Insect. Hym. Ponerinæ, p. 60, (1911) worker ♀ ♂.

Ponera denticulata, F. Smith, Cat. Hym. Brit. Mus. Vol. 6, p. 90. f. 13, 14, (1858) ♀ ; Roger, Berl. Ent. Zeitschr. Vol. 5, p. 11, (1861) worker.

O. denticulata, Mayr, Verh, Zool-bot. Ges. Wien, Vol. 12, p. 717, (1882).

There have been so many descriptions of *O. transversa* that another complete account of this easily recognized insect seems entirely superfluous. I shall give only those characteristics which are of use in distinguishing the typical form from the other variants.

Head and thorax piceous, the abdomen usually brownish black with the posterior borders of the segments narrowly edged with brown, rarely the entire abdomen piceous. Mandibles, clypeus, antennæ and legs ferrugineous; coxæ blackish brown. Long hairs moderately abundant, golden; pubescence whitish yellow, very sparse on the rugose portions but abundant elsewhere, particularly long and thick on the subpetiolar lamella. Rugæ coarse, opaque or subopa-

que, their surfaces, much roughened by numerous small impressions and ridges, cephalic rugæ rougher than those of the thorax. Antennæ with a few shining oval punctures. Head approximately as broad as long, broadest between the posterior fourth and fifth, the sides feebly convex, the occiput broadly and evently concave. Epinotum with two divergent, serrate carinæ consisting of three or four obtuse teeth at the junction of the basal and declivious faces.

The collection contains numerous specimens from southern China and Burma and a few from Indochina. There is a very large amount of material from the Philippines, two workers and a female from northern Borneo and a number of specimens from Java.

Ondontoponera transversa var. **infuscata** var. nov.

This variety differs from the typical form in the color of the clypeus and the appendages. The mandibles, clypeus, antennæ and legs are blackish brown. The rugæ are in most cases more shining than in the true *transversa*.

Infuscata appears to be confined to Java and some of the closely adjacent Sunda Islands. A large series of workers taken by L. G. E. Kalshoven in the teak forests of Samarang, Java, may be considered as type material. There are a few specimens taken by N. Gist Gee in Buitenzorg, Java, and others from Mao Marroe, East Soemba (Sunda Islands) collected by Dammerman.

Odontoponera transversa subsp. **biconcentrica,**

Wheeler & Chapman.

Odontoponera transversa var. biconcentrica, Wheeler & Chapman, Philippine Jour. of Sci. Vol. 28, No. 1, (1925) worker.

Biconcentrica was originally separated on the circular configuration of the rugæ of the pronotum but, as has been already shown, the value of this character is lessened since it sometimes occurs in the typical *transversa*. There are, however, a number of other differences. The head of *bicon-*

centrica is approximately one fifth longer than broad with the sides parallel or nearly so, the occipital impression is somewhat feebler and a little more angular than in the true *transversa*. The color is a peculiar dull, brownish yellow with the abdomen slightly darker. The punctures on the antennal scapes are circular and deeply pigmented which gives the scapes a speckled appearance. The rugæ are smoother and more shining than the typical form but much less so than in the subspecies *nitens*.

Biconcentrica was described from a single worker taken by Baker on Basilan Island, P. I. There are two others in the collection secured by Sylvestri at Shatin, China. The latter are a trifle smaller and lighter in color than the type but obviously belong to this subspecies.

Odontoponera transversa subsp. **nitens** subsp. nov.

The rugæ of *nitens* are finer and much more shining than those of the other forms. The divergent carinæ at the angle of the basal and declivious faces of the epinotum are reduced to one or two small, rather acute teeth. The subpetiolar lamella is feebly pilose, in some specimens virtually bare. As a general rule the node of the petiole is narrower with a more deeply notchd summit than in the other forms but this character cannot be relied upon since the shape of the petiole is highly variable. The color of *nitens* is quite distinct. The head and thorax vary from ferrugineous to blackish red with the appendages and abdomen brownish red or yellow.

I have designated as types a series of workers collected by E. Mjöberg in North Borneo. I have seen others from Kuching, Borneo, (H. Smith), Depok, Java, (Dammerman), Wai Lima, South Sumatra, (Karny) Dœrian, Riouw Archipelago, (Dammerman), and Singapore, (Baker).

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By C. T. Brues and A. L. Melander

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